September 2014

# LM78XX / LM78XXA
# 3-Terminal 1 A Positive Voltage Regulator

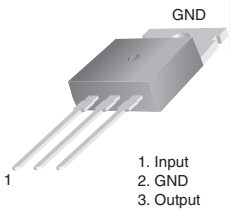
## Features

- Output Current up to 1 A
- Output Voltages: 5, 6, 8, 9, 10, 12, 15, 18, 24 V
- Thermal Overload Protection
- Short-Circuit Protection
- Output Transistor Safe Operating Area Protection

## Description

The LM78XX series of three-terminal positive regulators is available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut-down, and safe operating area protection. If adequate heat sinking is provided, they can deliver over 1 A output current. Although designed primarily as fixed-voltage regulators, these devices can be used with external components for adjustable voltages and currents.

**TO-220** (Single Gauge)




## Ordering Information(1)

| Product Number | Output Voltage Tolerance | Package | Operating Temperature | Packing Method |
|---|---|---|---|---|
| LM7805CT | ±4% | TO-220 (Single Gauge) | -40°C to +125°C | Rail |
| LM7806CT | | | | |
| LM7808CT | | | | |
| LM7809CT | | | | |
| LM7810CT | | | | |
| LM7812CT | | | | |
| LM7815CT | | | | |
| LM7818CT | | | | |
| LM7824CT | | | | |
| LM7805ACT | ±2% | | 0°C to +125°C | |
| LM7809ACT | | | | |
| LM7810ACT | | | | |
| LM7812ACT | | | | |
| LM7815ACT | | | | |

**Note:**

1. Above output voltage tolerance is available at 25°C.

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## Block Diagram

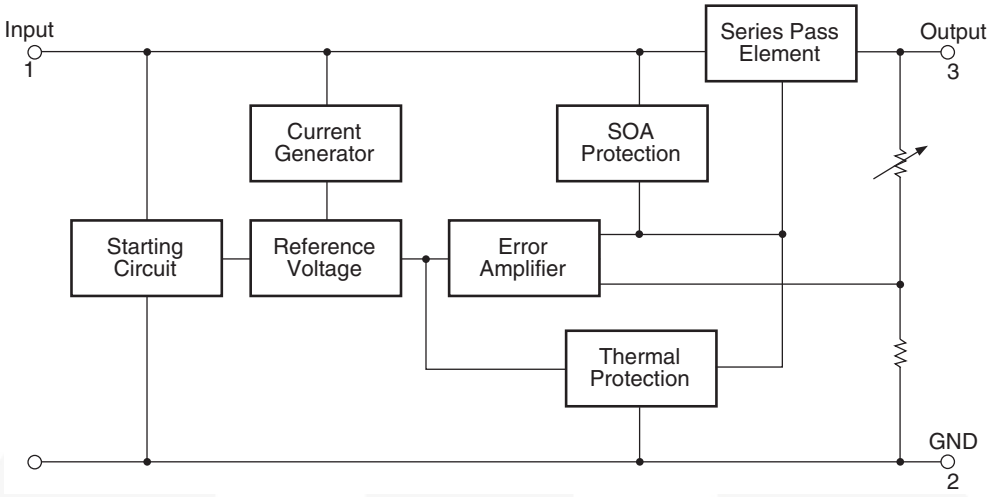


**Figure 1. Block Diagram**

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at $T_A$ = 25°C unless otherwise noted.

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_I$ | Input Voltage | $V_O$ = 5 V to 18 V | 35 | V |
| | | $V_O$ = 24 V | 40 | |
| $R_{\theta JC}$ | Thermal Resistance, Junction-Case (TO-220) | | 5 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-Air (TO-220) | | 65 | °C/W |
| $T_{OPR}$ | Operating Temperature Range | LM78xx | -40 to +125 | °C |
| | | LM78xxA | 0 to +125 | |
| $T_{STG}$ | Storage Temperature Range | | - 65 to +150 | °C |

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## Electrical Characteristics (LM7805)

Refer to the test circuit, -40°C < $T_J$ < 125°C, $I_O$ = 500 mA, $V_I$ = 10 V, $C_I$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 4.80 | 5.00 | 5.20 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 7 V to 20 V | | 4.75 | 5.00 | 5.25 | |
| Regline | Line Regulation[2] | $T_J$ = +25°C | $V_I$ = 7 V to 25 V | | 4.0 | 100.0 | mV |
| | | | $V_I$ = 8 V to 12 V | | 1.6 | 50.0 | |
| Regload | Load Regulation[2] | $T_J$ = +25°C | $I_O$ = 5 mA to 1.5 A | | 9.0 | 100.0 | mV |
| | | | $I_O$ = 250 mA to 750 mA | | 4.0 | 50.0 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5 | 8 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | 0.03 | 0.50 | mA |
| | | $V_I$ = 7 V to 25 V | | | 0.30 | 1.30 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift[3] | $I_O$ = 5 mA | | | -0.8 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 42 | | µV |
| RR | Ripple Rejection[3] | f = 120 Hz, $V_I$ = 8 V to 18 V | | 62 | 73 | | dB |
| $V_{DROP}$ | Dropout Voltage | $T_J$ = +25°C, $I_O$ = 1 A | | | 2 | | V |
| $R_O$ | Output Resistance[3] | f = 1 kHz | | | 15 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $T_J$ = +25°C, $V_I$ = 35 V | | | 230 | | mA |
| $I_{PK}$ | Peak Current[3] | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

2. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
3. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7806)

Refer to the test circuit, -40°C < $T_J$ < 125°C, $I_O$ = 500 mA, $V_I$ = 11 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 5.75 | 6.00 | 6.25 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 8.0 V to 21 V | | 5.70 | 6.00 | 6.30 | |
| Regline | Line Regulation(4) | $T_J$ = +25°C | $V_I$ = 8 V to 25 V | | 5.0 | 120.0 | mV |
| | | | $V_I$ = 9 V to 13 V | | 1.5 | 60.0 | |
| Regload | Load Regulation(4) | $T_J$ = +25°C | $I_O$ = 5 mA to 1.5 A | | 9.0 | 120.0 | mV |
| | | | $I_O$ = 250 mA to 750 mA | | 3.0 | 60.0 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5 | 8 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | | 0.5 | mA |
| | | $V_I$ = 8 V to 25 V | | | | 1.3 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift(5) | $I_O$ = 5 mA | | | -0.8 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 45 | | µV |
| RR | Ripple Rejection(5) | f = 120 Hz, $V_I$ = 8 V to 18 V | | 62 | 73 | | dB |
| $V_{DROP}$ | Dropout Voltage | $T_J$ = +25°C, $I_O$ = 1 A | | | 2 | | V |
| $R_O$ | Output Resistance(5) | f = 1 kHz | | | 19 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $T_J$ = +25°C, $V_I$ = 35 V | | | 250 | | mA |
| $I_{PK}$ | Peak Current(5) | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

4. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
5. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7808)

Refer to the test circuit, -40°C < $T_J$ < 125°C, $I_O$ = 500 mA, $V_I$ = 14 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 7.7 | 8.0 | 8.3 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 10.5 V to 23 V | | 7.6 | 8.0 | 8.4 | |
| Regline | Line Regulation(6) | $T_J$ = +25°C | $V_I$ = 10.5 V to 25 V | | 5 | 160 | mV |
| | | | $V_I$ = 11.5 V to 17 V | | 2 | 80 | |
| Regload | Load Regulation(6) | $T_J$ = +25°C | $I_O$ = 5 mA to 1.5 A | | 10 | 160 | mV |
| | | | $I_O$ = 250 mA to 750 mA | | 5 | 80 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5 | 8 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | 0.05 | 0.50 | mA |
| | | $V_I$ = 10.5 V to 25 V | | | 0.5 | 1.0 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift(7) | $I_O$ = 5 mA | | | -0.8 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 52 | | µV |
| RR | Ripple Rejection(7) | f = 120 Hz, $V_I$ = 11.5 V to 21.5 V | | 56 | 73 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance(7) | f = 1 kHz | | | 17 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 230 | | mA |
| $I_{PK}$ | Peak Current(7) | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

6. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
7. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7809)

Refer to the test circuit, -40°C < $T_J$ < 125°C, $I_O$ = 500 mA, $V_I$ = 15 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 8.65 | 9.00 | 9.35 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 11.5 V to 24 V | | 8.60 | 9.00 | 9.40 | |
| Regline | Line Regulation(8) | $T_J$ = +25°C | $V_I$ = 11.5 V to 25 V | | 6 | 180 | mV |
| | | | $V_I$ = 12 V to 17 V | | 2 | 90 | |
| Regload | Load Regulation(8) | $T_J$ = +25°C | $I_O$ = 5 mA to 1.5 A | | 12 | 180 | mV |
| | | | $I_O$ = 250 mA to 750 mA | | 4 | 90 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5 | 8 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | | 0.5 | mA |
| | | $V_I$ = 11.5 V to 26 V | | | | 1.3 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift(9) | $I_O$ = 5 mA | | | -1 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 58 | | µV |
| RR | Ripple Rejection(9) | f = 120 Hz, $V_I$ = 13 V to 23 V | | 56 | 71 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance(9) | f = 1 kHz | | | 17 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 250 | | mA |
| $I_{PK}$ | Peak Current(9) | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

8. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
9. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7810)

Refer to the test circuit, -40°C < $T_J$ < 125°C, $I_O$ = 500 mA, $V_I$ = 16 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 9.6 | 10.0 | 10.4 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 12.5 V to 25 V | | 9.5 | 10.0 | 10.5 | |
| Regline | Line Regulation(10) | $T_J$ = +25°C | $V_I$ = 12.5 V to 25 V | | 10 | 200 | mV |
| | | | $V_I$ = 13 V to 25 V | | 3 | 100 | |
| Regload | Load Regulation(10) | $T_J$ = +25°C | $I_O$ = 5 mA to 1.5 A | | 12 | 200 | mV |
| | | | $I_O$ = 250 mA to 750 mA | | 4 | 400 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5.1 | 8.0 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | | 0.5 | mA |
| | | $V_I$ = 12.5 V to 29 V | | | | 1.0 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift(11) | $I_O$ = 5 mA | | | -1 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 58 | | µV |
| RR | Ripple Rejection(11) | f = 120 Hz, $V_I$ = 13 V to 23 V | | 56 | 71 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance(11) | f = 1 kHz | | | 17 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 250 | | mA |
| $I_{PK}$ | Peak Current(11) | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

10. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
11. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7812)

Refer to the test circuit, -40°C < $T_J$ < 125°C, $I_O$ = 500 mA, $V_I$ = 19 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 11.5 | 12.0 | 12.5 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 14.5 V to 27 V | | 11.4 | 12.0 | 12.6 | |
| Regline | Line Regulation[12] | $T_J$ = +25°C | $V_I$ = 14.5 V to 30 V | | 10 | 240 | mV |
| | | | $V_I$ = 16 V to 22 V | | 3 | 120 | |
| Regload | Load Regulation[12] | $T_J$ = +25°C | $I_O$ = 5 mA to 1.5 A | | 11 | 240 | mV |
| | | | $I_O$ = 250 mA to 750 mA | | 5 | 120 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5.1 | 8.0 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | 0.1 | 0.5 | mA |
| | | $V_I$ = 14.5 V to 30 V | | | 0.5 | 1.0 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift[13] | $I_O$ = 5 mA | | | -1 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 76 | | µV |
| RR | Ripple Rejection[13] | f = 120 Hz, $V_I$ = 15 V to 25 V | | 55 | 71 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance[13] | f = 1 kHz | | | 18 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 230 | | mA |
| $I_{PK}$ | Peak Current[13] | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

12. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
13. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7815)

Refer to the test circuit, -40°C < $T_J$ < 125°C, $I_O$ = 500 mA, $V_I$ = 23 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 14.40 | 15.00 | 15.60 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 17.5 V to 30 V | | 14.25 | 15.00 | 15.75 | |
| Regline | Line Regulation(14) | $T_J$ = +25°C | $V_I$ = 17.5 V to 30 V | | 11 | 300 | mV |
| | | | $V_I$ = 20 V to 26 V | | 3 | 150 | |
| Regload | Load Regulation(14) | $T_J$ = +25°C | $I_O$ = 5 mA to 1.5 A | | 12 | 300 | mV |
| | | | $I_O$ = 250 mA to 750 mA | | 4 | 150 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5.2 | 8.0 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | | 0.5 | mA |
| | | $V_I$ = 17.5 V to 30 V | | | | 1.0 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift(15) | $I_O$ = 5 mA | | | -1 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 90 | | µV |
| RR | Ripple Rejection(15) | f = 120 Hz, $V_I$ = 18.5 V to 28.5 V | | 54 | 70 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance(15) | f = 1 kHz | | | 19 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 250 | | mA |
| $I_{PK}$ | Peak Current(15) | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

14. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
15. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7818)

Refer to the test circuit, -40°C < $T_J$ < 125°C, $I_O$ = 500 mA, $V_I$ = 27 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 17.3 | 18.0 | 18.7 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 21 V to 33 V | | 17.1 | 18.0 | 18.9 | |
| Regline | Line Regulation(16) | $T_J$ = +25°C | $V_I$ = 21 V to 33 V | | 15 | 360 | mV |
| | | | $V_I$ = 24 V to 30 V | | 5 | 180 | |
| Regload | Load Regulation(16) | $T_J$ = +25°C | $I_O$ = 5 mA to 1.5 A | | 15 | 360 | mV |
| | | | $I_O$ = 250 mA to 750 mA | | 5 | 180 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5.2 | 8.0 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | | 0.5 | mA |
| | | $V_I$ = 21 V to 33 V | | | | 1.0 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift(17) | $I_O$ = 5 mA | | | -1 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 110 | | µV |
| RR | Ripple Rejection(17) | f = 120 Hz, $V_I$ = 22 V to 32 V | | 53 | 69 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance(17) | f = 1 kHz | | | 22 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 250 | | mA |
| $I_{PK}$ | Peak Current(17) | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

16. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
17. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7824)

Refer to the test circuit, -40°C < $T_J$ < 125°C, $I_O$ = 500 mA, $V_I$ = 33 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 23.00 | 24.00 | 25.00 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 27 V to 38 V | | 22.80 | 24.00 | 25.25 | |
| Regline | Line Regulation[18] | $T_J$ = +25°C | $V_I$ = 27 V to 38 V | | 17 | 480 | mV |
| | | | $V_I$ = 30 V to 36 V | | 6 | 240 | |
| Regload | Load Regulation[18] | $T_J$ = +25°C | $I_O$ = 5 mA to 1.5 A | | 15 | 480 | mV |
| | | | $I_O$ = 250 mA to 750 mA | | 5 | 240 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5.2 | 8.0 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | 0.1 | 0.5 | mA |
| | | $V_I$ = 27 V to 38 V | | | 0.5 | 1.0 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift[19] | $I_O$ = 5 mA | | | -1.5 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 120 | | µV |
| RR | Ripple Rejection[19] | f = 120 Hz, $V_I$ = 28 V to 38 V | | 50 | 67 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance[19] | f = 1 kHz | | | 28 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 230 | | mA |
| $I_{PK}$ | Peak Current[19] | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

18. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
19. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7805A)

Refer to the test circuit, 0°C < $T_J$ < 125°C, $I_O$ = 1 A, $V_I$ = 10 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 4.9 | 5.0 | 5.1 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 7.5 V to 20 V | | 4.8 | 5.0 | 5.2 | |
| Regline | Line Regulation[20] | $V_I$ = 7.5 V to 25 V, $I_O$ = 500 mA | | | 5.0 | 50.0 | mV |
| | | $V_I$ = 8 V to 12 V | | | 3.0 | 50.0 | |
| | | $T_J$ = +25°C | $V_I$ = 7.3 V to 20 V | | 5.0 | 50.0 | |
| | | | $V_I$ = 8 V to 12 V | | 1.5 | 25.0 | |
| Regload | Load Regulation[20] | $T_J$ = +25°C, $I_O$ = 5 mA to 1.5 A | | | 9 | 100 | mV |
| | | $I_O$ = 5 mA to 1 A | | | 9 | 100 | |
| | | $I_O$ = 250 mA to 750 mA | | | 4 | 50 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5 | 6 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | | 0.5 | mA |
| | | $V_I$ = 8 V to 25 V, $I_O$ = 500 mA | | | | 0.8 | |
| | | $V_I$ = 7.5 V to 20 V, $T_J$ = +25°C | | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift[21] | $I_O$ = 5 mA | | | -0.8 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 42 | | µV |
| RR | Ripple Rejection[21] | f = 120 Hz, $V_O$ = 500 mA, $V_I$ =8 V to 18 V | | | 68 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance[21] | f = 1 kHz | | | 17 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 250 | | mA |
| $I_{PK}$ | Peak Current[21] | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

20. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
21. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7809A)

Refer to the test circuit, 0°C < $T_J$ < 125°C, $I_O$ = 1 A, $V_I$ = 15 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 8.82 | 9.00 | 9.16 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 11.2 V to 24 V | | 8.65 | 9.00 | 9.35 | |
| Regline | Line Regulation[22] | $V_I$ = 11.7 V to 25 V, $I_O$ = 500 mA | | | 6 | 90 | mV |
| | | $V_I$ = 12.5 V to 19 V | | | 4 | 45 | |
| | | $T_J$ = +25°C | $V_I$ = 11.5 V to 24 V | | 6 | 90 | |
| | | | $V_I$ = 12.5 V to 19 V | | 2 | 45 | |
| Regload | Load Regulation[22] | $T_J$ = +25°C, $I_O$ = 5 mA to 1.5 A | | | 12 | 100 | mV |
| | | $I_O$ = 5 mA to 1 A | | | 12 | 100 | |
| | | $I_O$ = 250 mA to 750 mA | | | 5 | 50 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5 | 6 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | | 0.5 | mA |
| | | $V_I$ = 12 V to 25 V, $I_O$ = 500 mA | | | | 0.8 | |
| | | $V_I$ = 11.7 V to 25 V, $T_J$ = +25°C | | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift[23] | $I_O$ = 5 mA | | | -1 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 58 | | µV |
| RR | Ripple Rejection[23] | f = 120 Hz, $V_O$ = 500 mA, $V_I$ =12 V to 22 V | | | 62 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance[23] | f = 1 kHz | | | 17 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 250 | | mA |
| $I_{PK}$ | Peak Current[23] | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

22. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
23. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7810A)

Refer to the test circuit, 0°C < $T_J$ < 125°C, $I_O$ = 1 A, $V_I$ = 16 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 9.8 | 10.0 | 10.2 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 12.8 V to 25 V | | 9.6 | 10.0 | 10.4 | |
| Regline | Line Regulation[24] | $V_I$ = 12.8 V to 26 V, $I_O$ = 500 mA | | | 8 | 100 | mV |
| | | $V_I$ = 13 V to 20 V | | | 4 | 50 | |
| | | $T_J$ = +25°C | $V_I$ = 12.5 V to 25 V | | 8 | 100 | |
| | | | $V_I$ = 13 V to 20 V | | 3 | 50 | |
| Regload | Load Regulation[24] | $T_J$ = +25°C, $I_O$ = 5 mA to 1.5 A | | | 12 | 100 | mV |
| | | $I_O$ = 5 mA to 1 A | | | 12 | 100 | |
| | | $I_O$ = 250 mA to 750 mA | | | 5 | 50 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5 | 6 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | | 0.5 | mA |
| | | $V_I$ = 12.8 V to 25 V, $I_O$ = 500 mA | | | | 0.8 | |
| | | $V_I$ = 13 V to 26 V, $T_J$ = +25°C | | | | 0.5 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift[25] | $I_O$ = 5 mA | | | -1 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 58 | | µV |
| RR | Ripple Rejection[25] | f = 120 Hz, $V_O$ = 500 mA, $V_I$ =14 V to 24 V | | | 62 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance[25] | f = 1 kHz | | | 17 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 250 | | mA |
| $I_{PK}$ | Peak Current[25] | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

24. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
25. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7812A)

Refer to the test circuit, 0°C < $T_J$ < 125°C, $I_O$ = 1 A, $V_I$ = 19 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 11.75 | 12.00 | 12.25 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 14.8 V to 27 V | | 11.50 | 12.00 | 12.50 | |
| Regline | Line Regulation[26] | $V_I$ = 14.8 V to 30 V, $I_O$ = 500 mA | | | 10 | 120 | mV |
| | | $V_I$ = 16 V to 22 V | | | 4 | 120 | |
| | | $T_J$ = +25°C | $V_I$ = 14.5 V to 27 V | | 10 | 120 | |
| | | | $V_I$ = 16 V to 22 V | | 3 | 60 | |
| Regload | Load Regulation[26] | $T_J$ = +25°C, $I_O$ = 5 mA to 1.5 A | | | 12 | 100 | mV |
| | | $I_O$ = 5 mA to 1 A | | | 12 | 100 | |
| | | $I_O$ = 250 mA to 750 mA | | | 5 | 50 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5 | 6 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | | 0.5 | mA |
| | | $V_I$ = 14 V to 27 V, $I_O$ = 500 mA | | | | 0.8 | |
| | | $V_I$ = 15 V to 30 V, $T_J$ = +25°C | | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift[27] | $I_O$ = 5 mA | | | -1 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 76 | | µV |
| RR | Ripple Rejection[27] | f = 120 Hz, $V_O$ = 500 mA, $V_I$ =14 V to 24 V | | | 60 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance[27] | f = 1 kHz | | | 18 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 250 | | mA |
| $I_{PK}$ | Peak Current[27] | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

26. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
27. These parameters, although guaranteed, are not 100% tested in production.

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## Electrical Characteristics (LM7815A)

Refer to the test circuit, 0°C < $T_J$ < 125°C, $I_O$ = 1 A, $V_I$ = 23 V, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $T_J$ = +25°C | | 14.75 | 15.00 | 15.30 | V |
| | | $I_O$ = 5 mA to 1 A, $P_O \leq$ 15 W, $V_I$ = 17.7 V to 30 V | | 14.40 | 15.00 | 15.60 | |
| Regline | Line Regulation[28] | $V_I$ = 17.4 V to 30 V, $I_O$ = 500 mA | | | 10 | 150 | mV |
| | | $V_I$ = 20 V to 26 V | | | 5 | 150 | |
| | | $T_J$ = +25°C | $V_I$ = 17.5 V to 30 V | | 11 | 150 | |
| | | | $V_I$ = 20 V to 26 V | | 3 | 75 | |
| Regload | Load Regulation[28] | $T_J$ = +25°C, $I_O$ = 5 mA to 1.5 A | | | 12 | 100 | mV |
| | | $I_O$ = 5 mA to 1 A | | | 12 | 100 | |
| | | $I_O$ = 250 mA to 750 mA | | | 5 | 50 | |
| $I_Q$ | Quiescent Current | $T_J$ = +25°C | | | 5.2 | 6.0 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5 mA to 1 A | | | | 0.5 | mA |
| | | $V_I$ = 17.5 V to 30 V, $I_O$ = 500 mA | | | | 0.8 | |
| | | $V_I$ = 17.5 V to 30 V, $T_J$ = +25°C | | | | 0.8 | |
| $\Delta V_O/\Delta T$ | Output Voltage Drift[29] | $I_O$ = 5 mA | | | -1 | | mV/°C |
| $V_N$ | Output Noise Voltage | f = 10 Hz to 100 kHz, $T_A$ = +25°C | | | 90 | | µV |
| RR | Ripple Rejection[29] | f = 120 Hz, $V_O$ = 500 mA, $V_I$ =18.5 V to 28.5 V | | | 58 | | dB |
| $V_{DROP}$ | Dropout Voltage | $I_O$ = 1 A, $T_J$ = +25°C | | | 2 | | V |
| $R_O$ | Output Resistance[29] | f = 1 kHz | | | 19 | | mΩ |
| $I_{SC}$ | Short-Circuit Current | $V_I$ = 35 V, $T_J$ = +25°C | | | 250 | | mA |
| $I_{PK}$ | Peak Current[29] | $T_J$ = +25°C | | | 2.2 | | A |

**Notes:**

28. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty is used.
29. These parameters, although guaranteed, are not 100% tested in production.

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## Typical Performance Characteristics

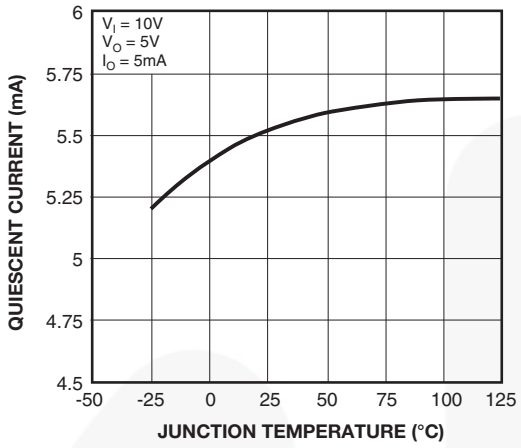


**Figure 2. Quiescent Current**

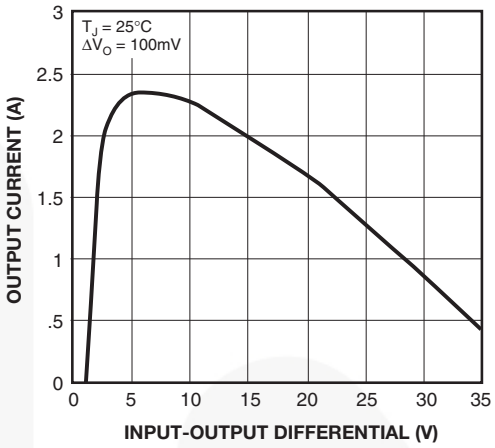


**Figure 3. Peak Output Current**

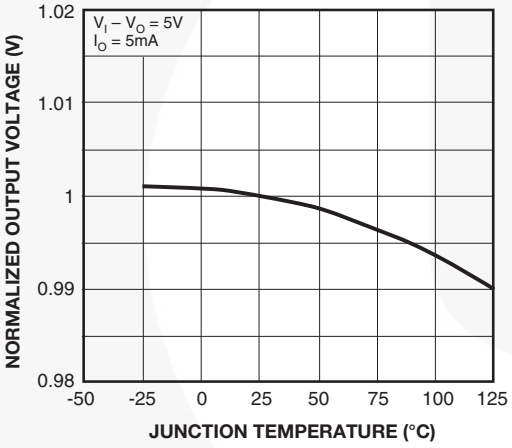


**Figure 4. Output Voltage**

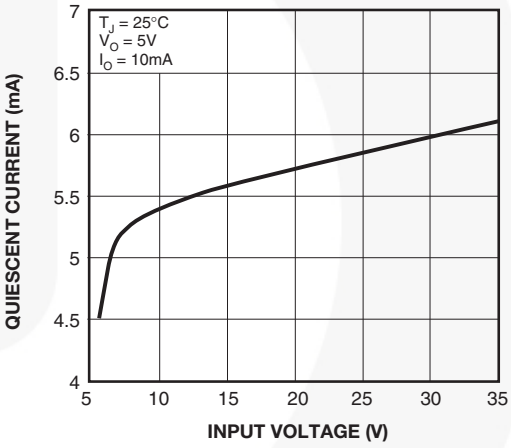


**Figure 5. Quiescent Current**

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## Typical Applications

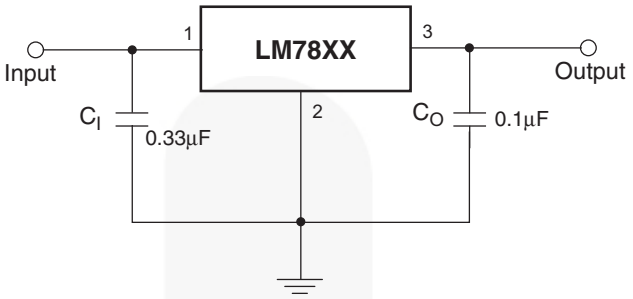


**Figure 6. DC Parameters**

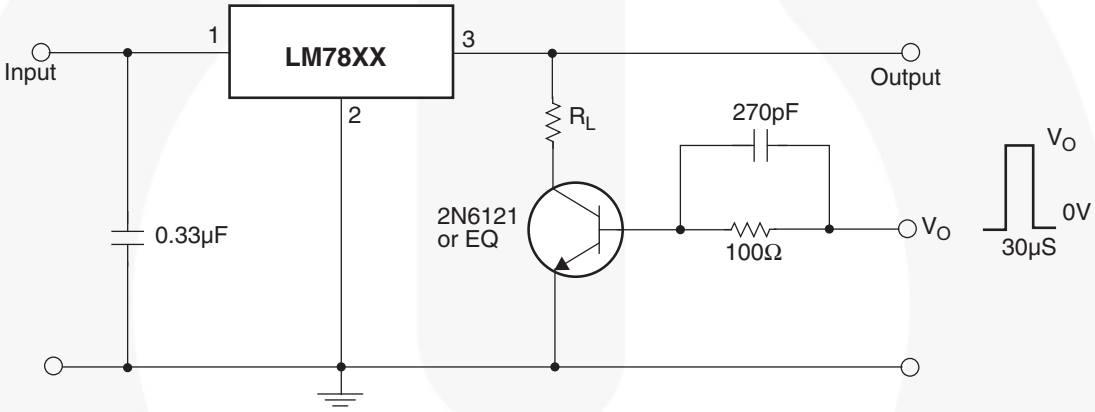


**Figure 7. Load Regulation**

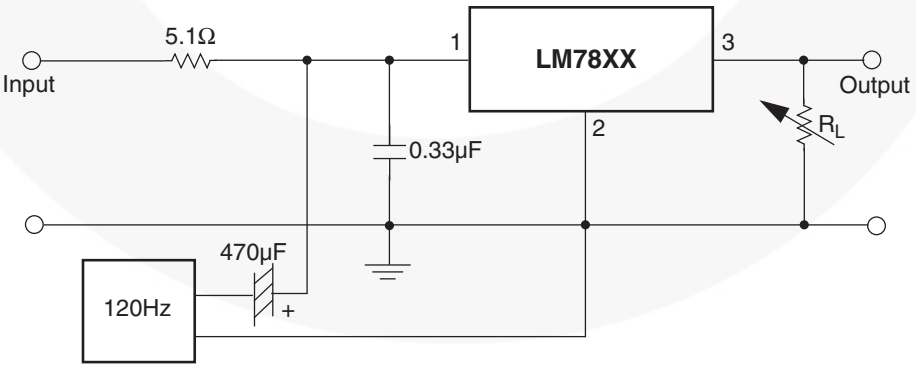


**Figure 8. Ripple Rejection**

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## Typical Applications (Continued)

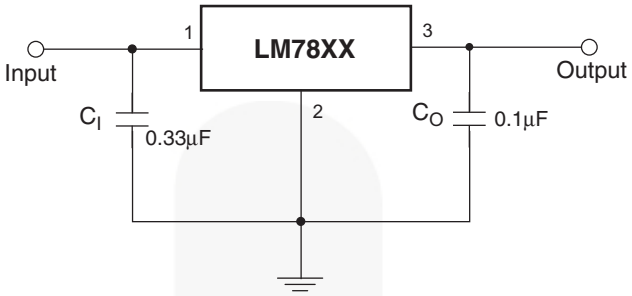


**Figure 9. Fixed-Output Regulator**

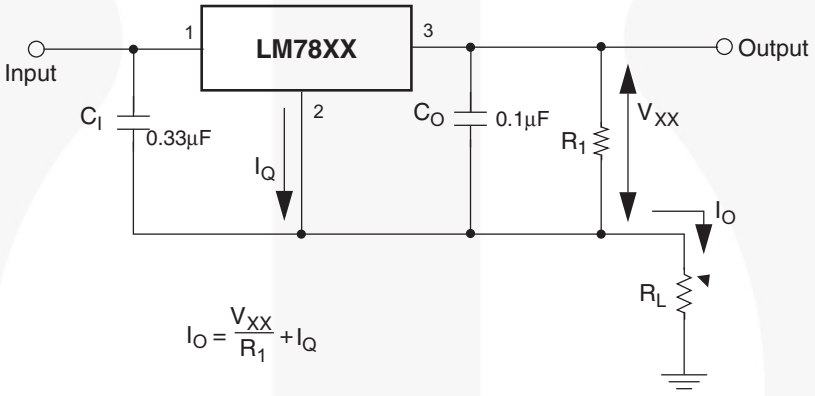


**Figure 10. Constant Current Regulator**

**Notes:**

29. To specify an output voltage, substitute voltage value for “XX”. A common ground is required between the input and the output voltage. The input voltage must remain typically 2.0 V above the output voltage even during the low point on the input ripple voltage.
30. $C_I$ is required if regulator is located an appreciable distance from power supply filter.
31. $C_O$ improves stability and transient response.

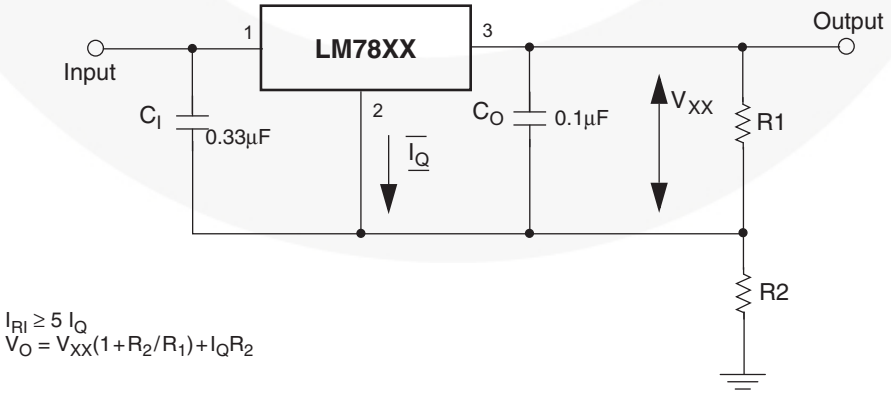


**Figure 11. Circuit for Increasing Output Voltage**

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## Typical Applications (Continued)

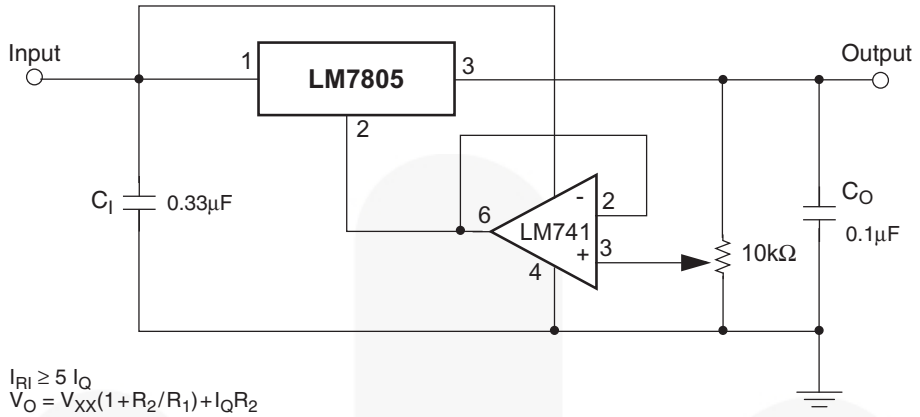


**Figure 12. Adjustable Output Regulator (7 V to 30 V)**

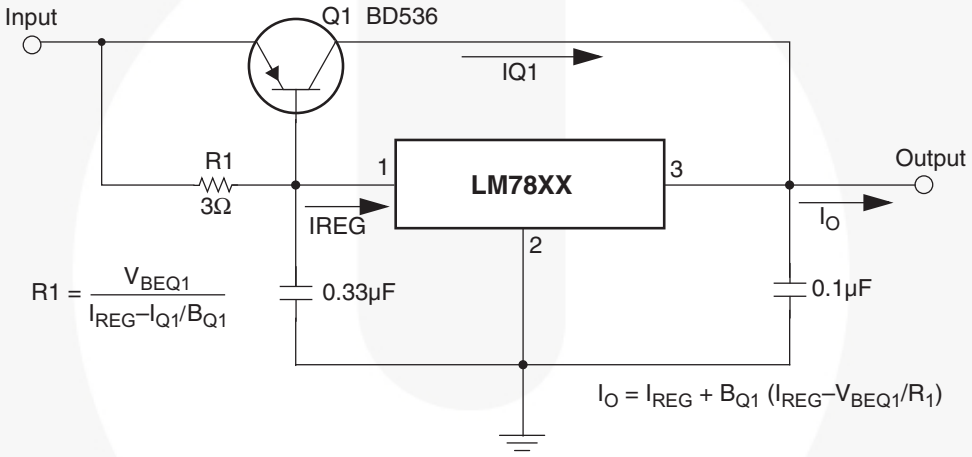


**Figure 13. High-Current Voltage Regulator**

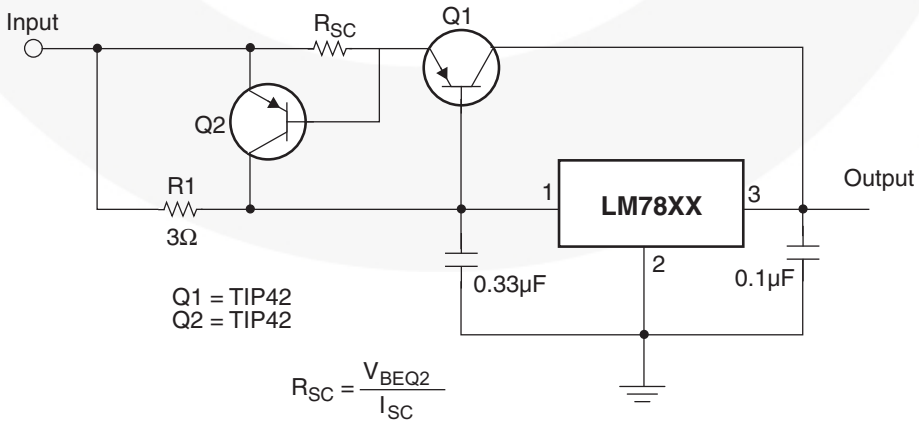


**Figure 14. High Output Current with Short-Circuit Protection**

## Typical Applications (Continued)

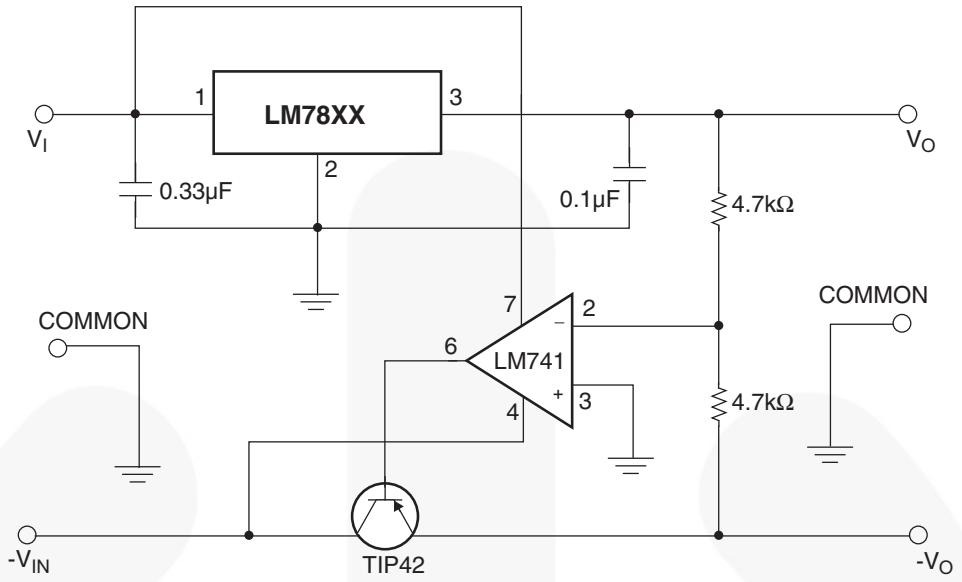


**Figure 15. Tracking Voltage Regulator**

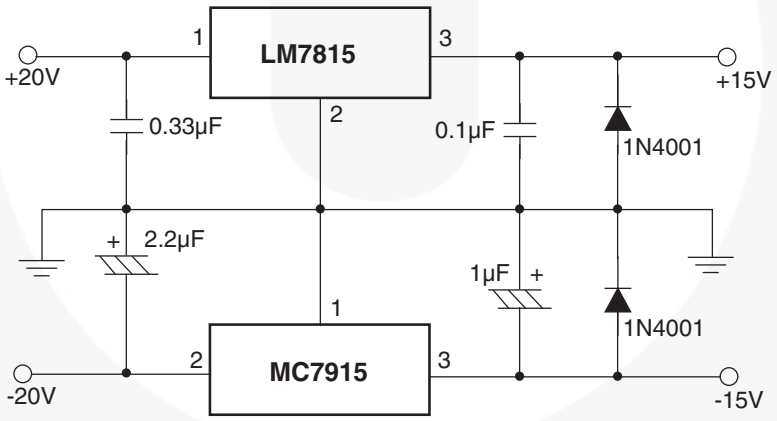


**Figure 16. Split Power Supply (±15 V - 1 A)**

## Typical Applications (Continued)

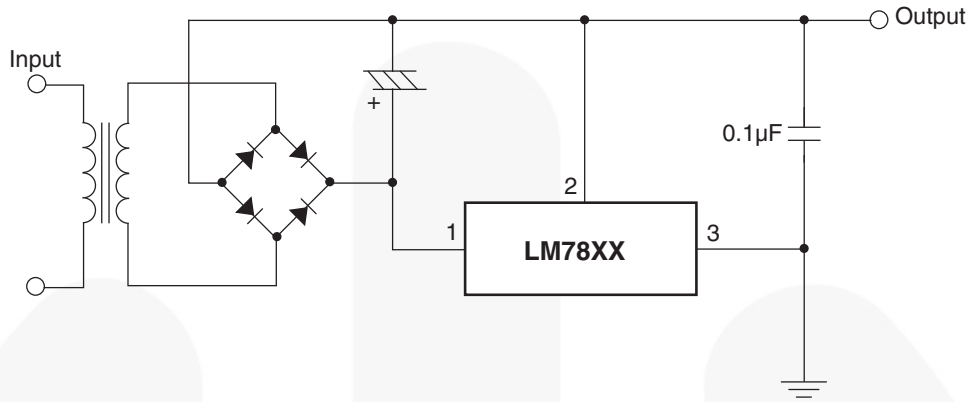


**Figure 17. Negative Output Voltage Circuit**

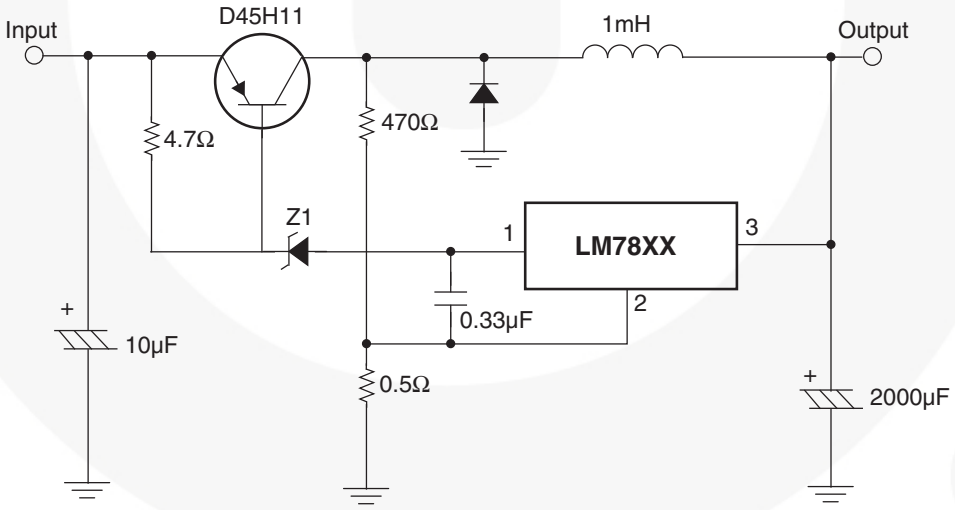


**Figure 18. Switching Regulator**

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## Physical Dimensions

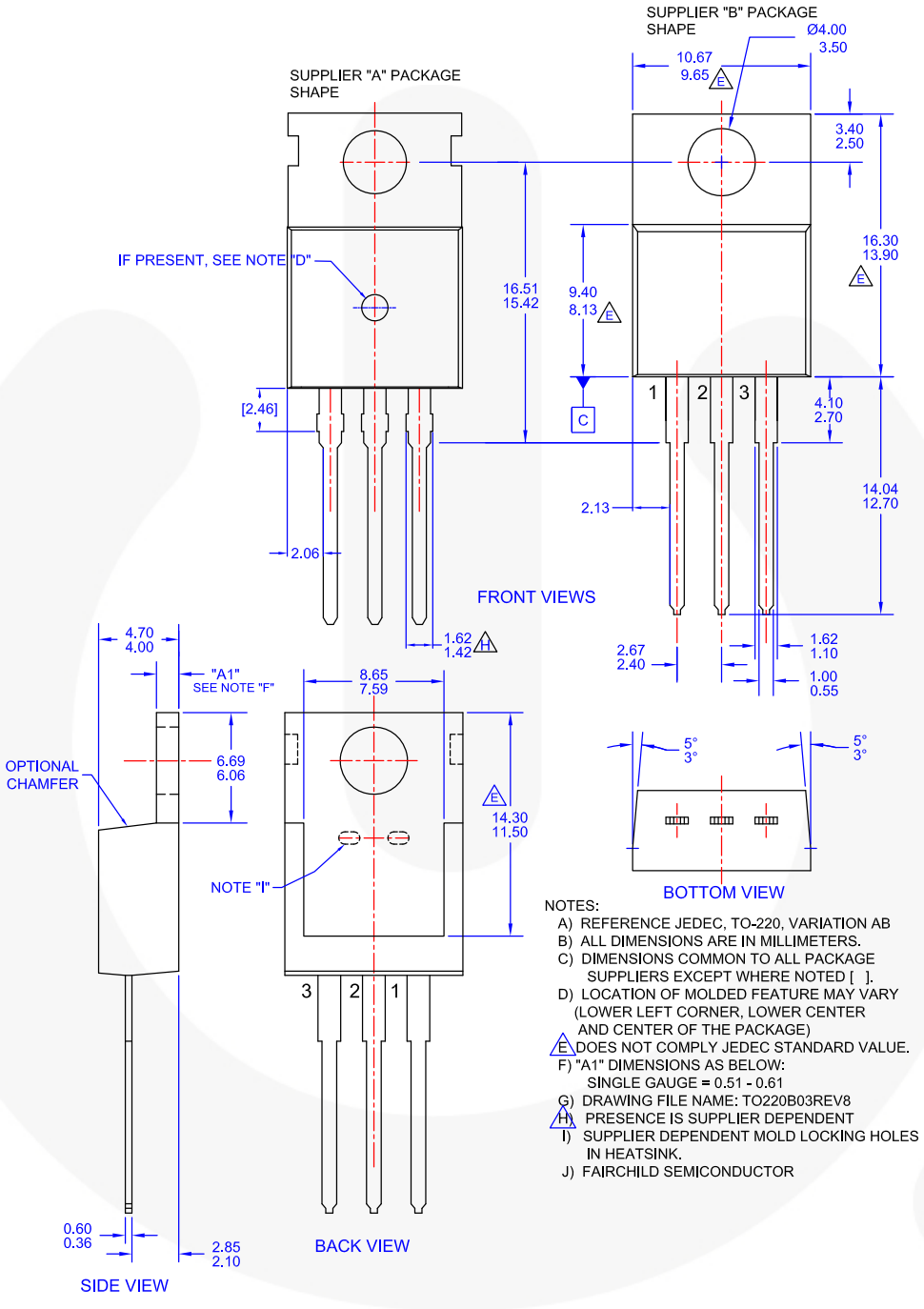


**Figure 19. TO-220, MOLDED, 3-LEAD, JEDEC VARIATION AB (ACTIVE)**

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G*max*™
GTO™
IntelliMAX™
ISOPLANAR™
Making Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
MotionGrid®
MTi®
MTx®
MVN®
mWSaver®
OptoHiT™
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Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
™
Saving our world, 1mW/W/kW at a time™
SignalWise™
SmartMax™
SMART START™
Solutions for Your Success™
SPM®
STEALTH™
SuperFET®
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS®
SyncFET™
Sync-Lock™
SYSTEM GENERAL®*
TinyBoost®
TinyBuck®
TinyCalc™
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TINYOPTO™
TinyPower™
TinyPWM™
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TranSiC™
TriFault Detect™
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µSerDes™
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