

THREE-TERMINAL POSITIVE VOLTAGE REGULATORS

These voltage regulators are monolithic integrated circuits designed as fixed-voltage regulators for a wide variety of applications including local, on-card regulation. These regulators employ internal current limiting, thermal shutdown, and safe-area

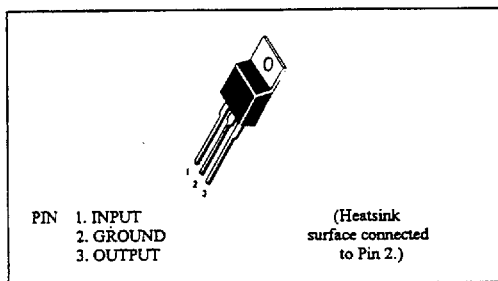
compensation. With adequate heatsinking they can deliver output currents in excess of 1.5 ampere.

Although designed primarily as a fixed voltage regulator, these devices can be used with external components to obtain adjustable voltages and currents.

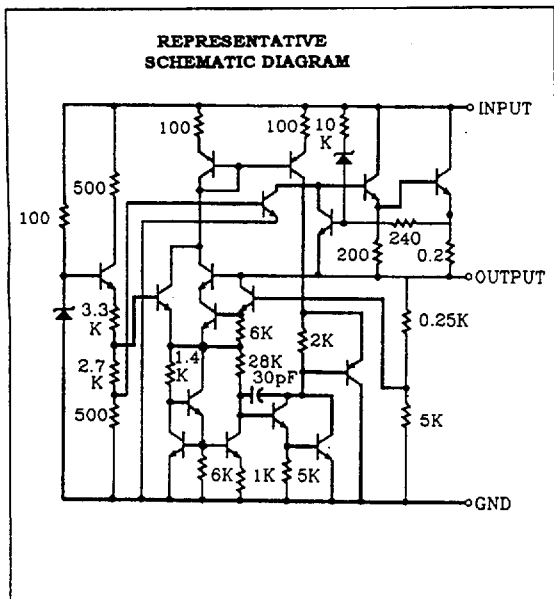
FEATURES

- Output Current in Excess of 1.5 Ampere
- No External Components Required
- Internal Thermal Overload Protection
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation
- Output Voltage Offered in 2% Tolerance

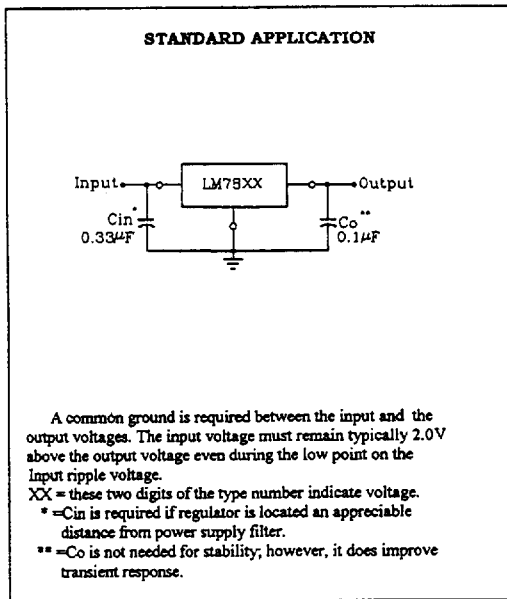
PIN ARRANGEMENT



CIRCUIT SCHEMATIC



TYPICAL CONNECTING CIRCUIT



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

| Item | Symbol | LM7800 Series | Unit |
|--------------------------------|--------------------|---------------|------|
| Input Voltage | Vin * | 30 | V |
| Input Voltage | Vin ** | 40 | V |
| Power Dissipation | P _D *** | 15 | W |
| Operating Ambient Temperature | T _{opr} | -20 to +75 | °C |
| Operating Junction Temperature | T _j | -20 to +125 | °C |
| Storage Temperature | T _{stg} | -55 to +125 | °C |

Note: *LM7805 to LM7818

** LM7824

***Follow the derating curve

LM7805 ELECTRICAL CHARACTERISTICS

(Vin=10V, I_{out}=500mA, 0°C ≤ T_j ≤ 125°C, C_{in}=0.33μF, C_{out}=0.1μF; unless otherwise specified.)

| Item | Symbol | Test Conditions | min. | typ. | max. | unit | |
|---|---------------------------------------|---|----------------------------------|------|------|-------|----|
| Output Voltage | V _{out} | T _j =25°C | 4.90 | 5.0 | 5.10 | V | |
| | | 7V ≤ V _{in} ≤ 20V, 5mA ≤ I _{out} ≤ 1.0A, P _D ≤ 15W | 4.85 | -- | 5.15 | V | |
| Line Regulation | REG _{line} | T _j =25°C | 7V ≤ V _{in} ≤ 25V | -- | 3 | 100 | mV |
| | | | 8V ≤ V _{in} ≤ 12V | -- | 1 | 50 | mV |
| | | | 5mA ≤ I _{out} ≤ 1.5A | -- | 15 | 100 | mV |
| Load Regulation | REG _{load} | T _j =25°C | 250mA ≤ I _{out} ≤ 750mA | -- | 5 | 50 | mV |
| Quiescent Current | I _q | T _j =25°C, I _{out} =0 | -- | 4.2 | 8.0 | mA | |
| Quiescent Current Change | Δ I _q | 7V ≤ V _{in} ≤ 25V | -- | -- | 1.3 | mA | |
| | | 5mA ≤ I _{out} ≤ 1.0A | -- | -- | 0.5 | mA | |
| Output Noise Voltage | V _n | T _a =25°C, 10Hz ≤ f ≤ 100KHz | -- | 40 | -- | μV | |
| Ripple Rejection Ratio | RR | f=120Hz | 62 | 78 | -- | dB | |
| Voltage Drop | V _{drop} | I _{out} =1.0A, T _j =25°C | -- | 2.0 | -- | V | |
| Output Resistance | R _{out} | f=1KHz | -- | 17 | -- | mΩ | |
| Output Short Circuit Current | I _{os} | T _j =25°C | -- | 750 | -- | mA | |
| Peak Output Current | I _{o peak} | T _j =25°C | -- | 2.2 | -- | A | |
| Temperature Coefficient of Output Voltage | Δ V _{out} / Δ T _j | I _{out} =5mA, 0°C ≤ T _j ≤ 125°C | -- | -1.1 | -- | mV/°C | |

LM7806 ELECTRICAL CHARACTERISTICS

(Vin=11V, Iout=500mA, 0°C ≤ Tj ≤ 125°C, Cin=0.33μF, Cout=0.1μF; unless otherwise specified.)

| Item | Symbol | Test Conditions | min. | typ. | max. | unit | |
|---|-------------|---|----------------------|------|------|-------|----|
| Output Voltage | Vout | Tj=25°C | 5.88 | 6.0 | 6.12 | V | |
| | | 8V ≤ Vin ≤ 21V, 5mA ≤ Iout ≤ 1.0A, PD ≤ 15W | 5.83 | -- | 6.17 | V | |
| Line Regulation | Δ REGline | Tj=25°C | 8V ≤ Vin ≤ 25V | -- | 5 | 120 | mV |
| | | | 9V ≤ Vin ≤ 13V | -- | 1.5 | 60 | mV |
| Load Regulation | Δ REGload | Tj=25°C | 5mA ≤ Iout ≤ 1.5A | -- | 14 | 120 | mV |
| | | | 250mA ≤ Iout ≤ 750mA | -- | 4.0 | 60 | mV |
| Quiescent Current | Iq | Tj=25°C, Iout=0 | -- | 4.3 | 8.0 | mA | |
| Quiescent Current Change | Δ Iq | Tj=25°C | 8V ≤ Vin ≤ 25V | -- | -- | 1.3 | mA |
| | | | 5mA ≤ Iout ≤ 1.0A | -- | -- | 0.5 | mA |
| Output Noise Voltage | Vn | Ta=25°C, 10Hz ≤ f ≤ 100KHz | -- | 45 | -- | μV | |
| Ripple Rejection Ratio | RR | f=120Hz | 59 | 75 | -- | dB | |
| Voltage Drop | Vdrop | Iout=1.0A, Tj=25°C | -- | 2.0 | -- | V | |
| Output Resistance | Rout | f=1KHz | -- | 19 | -- | mΩ | |
| Output Short Circuit Current | Ios | Tj=25°C | -- | 550 | -- | mA | |
| Peak Output Current | Io peak | Tj=25°C | -- | 2.2 | -- | A | |
| Temperature Coefficient of Output Voltage | Δ Vout/Δ Tj | Iout=5mA, 0°C ≤ Tj ≤ 125°C | -- | -0.8 | -- | mV/°C | |

LM7808 ELECTRICAL CHARACTERISTICS

(Vin=14V, Iout=500mA, 0°C ≤ Tj ≤ 125°C, Cin=0.33μF, Cout=0.1μF; unless otherwise specified.)

| Item | Symbol | Test Conditions | min. | typ. | max. | unit | |
|---|-------------|--|----------------------|------|------|-------|----|
| Output Voltage | Vout | Tj=25°C | 7.84 | 8.0 | 8.16 | V | |
| | | 10.5V ≤ Vin ≤ 23V, 5mA ≤ Iout ≤ 1.0A, PD ≤ 15W | 7.74 | -- | 8.26 | V | |
| Line Regulation | Δ REGline | Tj=25°C | 10.5V ≤ Vin ≤ 25V | -- | 6 | 160 | mV |
| | | | 11V ≤ Vin ≤ 17V | -- | 2.0 | 80 | mV |
| Load Regulation | Δ REGload | Tj=25°C | 5mA ≤ Iout ≤ 1.5A | -- | 12 | 160 | mV |
| | | | 250mA ≤ Iout ≤ 750mA | -- | 4 | 80 | mV |
| Quiescent Current | Iq | Tj=25°C, Iout=0 | -- | 4.3 | 8.0 | mA | |
| Quiescent Current Change | Δ Iq | Tj=25°C | 10.5V ≤ Vin ≤ 25V | -- | -- | 1.0 | mA |
| | | | 5mA ≤ Iout ≤ 1.0A | -- | -- | 0.5 | mA |
| Output Noise Voltage | Vn | Ta=25°C, 10Hz ≤ f ≤ 100KHz | -- | 52 | -- | μV | |
| Ripple Rejection Ratio | RR | f=120Hz | 56 | 72 | -- | dB | |
| Voltage Drop | Vdrop | Iout=1.0A, Tj=25°C | -- | 2.0 | -- | V | |
| Output Resistance | Rout | f=1KHz | -- | 16 | -- | mΩ | |
| Output Short Circuit Current | Ios | Tj=25°C | -- | 450 | -- | mA | |
| Peak Output Current | Io peak | Tj=25°C | -- | 2.2 | -- | A | |
| Temperature Coefficient of Output Voltage | Δ Vout/Δ Tj | Iout=5mA, 0°C ≤ Tj ≤ 125°C | -- | -1.8 | -- | mV/°C | |

LM7809 ELECTRICAL CHARACTERISTICS

(Vin=15V, Iout=500mA, 0°C ≤ Tj ≤ 125°C, Cin=0.33μF, Cout=0.1μF; unless otherwise specified.)

| Item | Symbol | Test Conditions | min. | typ. | max. | unit | |
|---|-------------|--|----------------------|------|------|-------|----|
| Output Voltage | Vout | Tj=25°C | 8.82 | 9 | 9.18 | V | |
| | | 10.5V ≤ Vin ≤ 27V, 5mA ≤ Iout ≤ 1.0A, Pd ≤ 15W | 8.77 | -- | 9.23 | V | |
| Line Regulation | Δ REGline | Tj=25°C | 11.5V ≤ Vin ≤ 30V | -- | 6 | 160 | mV |
| | | | 12V ≤ Vin ≤ 18V | -- | 2.0 | 80 | mV |
| Load Regulation | Δ REGload | Tj=25°C | 5mA ≤ Iout ≤ 1.5A | -- | 12 | 160 | mV |
| | | | 250mA ≤ Iout ≤ 750mA | -- | 4 | 80 | mV |
| Quiescent Current | Iq | Tj=25°C, Iout=0 | -- | 4.3 | 1.0 | mA | |
| Quiescent Current Change | Δ Iq | 5mA ≤ Iout ≤ 1.0A | 14.5V ≤ Vin ≤ 30V | -- | -- | 0.5 | mA |
| | | | 5mA ≤ Iout ≤ 1.0A | -- | -- | -- | mA |
| Output Noise Voltage | Vn | Ta=25°C, 10Hz ≤ fs ≤ 100KHz | -- | 52 | -- | μV | |
| Ripple Rejection Ratio | RR | f=120Hz | 55 | 72 | -- | dB | |
| Voltage Drop | Vdrop | Iout=1.0A, Tj=25°C | -- | 2.0 | -- | V | |
| Output Resistance | Rout | f=1KHz | -- | 16 | -- | mΩ | |
| Output Short Circuit Current | Ios | Tj=25°C | -- | 450 | -- | mA | |
| Peak Output Current | Io peak | Tj=25°C | -- | 2.2 | -- | A | |
| Temperature Coefficient of Output Voltage | Δ Vout/Δ Tj | Iout=5mA, 0°C ≤ Tj ≤ 125°C | -- | -1.8 | -- | mV/°C | |

LM7810 ELECTRICAL CHARACTERISTICS

(Vin=16V, Iout=500mA, 0°C ≤ Tj ≤ 125°C, Cin=0.33μF, Cout=0.1μF; unless otherwise specified.)

| Item | Symbol | Test Conditions | min. | typ. | max. | unit | |
|---|-------------|--|----------------------|------|-------|-------|----|
| Output Voltage | Vout | Tj=25°C | 9.8 | 10 | 10.2 | V | |
| | | 17.5V ≤ Vin ≤ 30V, 5mA ≤ Iout ≤ 1.0A, Pd ≤ 15W | 9.75 | - | 12.25 | V | |
| Line Regulation | Δ REGline | Tj=25°C | 10.5V ≤ Vin ≤ 30V | -- | 10 | 240 | mV |
| | | | 13V ≤ Vin ≤ 9V | -- | 3.0 | 120 | mV |
| Load Regulation | Δ REGload | Tj=25°C | 5mA ≤ Iout ≤ 1.5A | -- | 12 | 240 | mV |
| | | | 250mA ≤ Iout ≤ 750mA | -- | 4.0 | 120 | mV |
| Quiescent Current | Iq | Tj=25°C, Iout=0 | -- | 4.3 | 8.0 | mA | |
| Quiescent Current Change | Δ Iq | 5mA ≤ Iout ≤ 1.0A | 14.5V ≤ Vin ≤ 30V | -- | -- | 1.0 | mA |
| | | | 5mA ≤ Iout ≤ 1.0A | -- | -- | 0.5 | mA |
| Output Noise Voltage | Vn | Ta=25°C, 10Hz ≤ fs ≤ 100KHz | -- | 52 | -- | μV | |
| Ripple Rejection Ratio | RR | f=120Hz | 54 | 72 | -- | dB | |
| Voltage Drop | Vdrop | Iout=1.0A, Tj=25°C | -- | 2.0 | -- | V | |
| Output Resistance | Rout | f=1KHz | -- | 16 | -- | mΩ | |
| Output Short Circuit Current | Ios | Tj=25°C | -- | 450 | -- | mA | |
| Peak Output Current | Io peak | Tj=25°C | -- | 2.2 | -- | A | |
| Temperature Coefficient of Output Voltage | Δ Vout/Δ Tj | Iout=5mA, 0°C ≤ Tj ≤ 125°C | -- | -1.8 | -- | mV/°C | |

• LM7812 ELECTRICAL CHARACTERISTICS

(Vin=19V, Iout=500mA, 0°C ≤ Tj ≤ 125°C, Cin=0.33μF, Cout=0.1μF; unless otherwise specified.)

| Item | Symbol | Test Conditions | min. | typ. | max. | unit | |
|---|---------------------|--|----------------------|------|-------|-------|----|
| Output Voltage | Vout | Tj=25°C | 11.76 | 12.0 | 12.24 | V | |
| | | 14.5V ≤ Vin ≤ 27V, 5mA ≤ Iout ≤ 1.0A, P _D ≤ 15W | 11.66 | -- | 12.34 | V | |
| Line Regulation | Δ REGline | Tj=25°C | 14.5V ≤ Vin ≤ 30V | -- | 10 | 240 | mV |
| | | | 16V ≤ Vin ≤ 22V | -- | 3.0 | 120 | mV |
| Load Regulation | Δ REGload | Tj=25°C | 5mA ≤ Iout ≤ 1.5A | -- | 12 | 240 | mV |
| | | | 250mA ≤ Iout ≤ 750mA | -- | 4.0 | 120 | mV |
| Quiescent Current | Iq | Tj=25°C, Iout=0 | -- | 4.3 | 8.0 | mA | |
| Quiescent Current Change | Δ Iq | Tj=25°C | 14.5V ≤ Vin ≤ 30V | -- | -- | 1.0 | mA |
| | | | 5mA ≤ Iout ≤ 1.0A | -- | -- | 0.5 | mA |
| Output Noise Voltage | Vn | Ta=25°C, 10Hz ≤ f ≤ 100KHz | -- | 75 | -- | μV | |
| Ripple Rejection Ratio | RR | f=120Hz | 55 | 71 | -- | dB | |
| Voltage Drop | Vdrop | Iout=1.0A, Tj=25°C | -- | 2.0 | -- | V | |
| Output Resistance | Rout | f=1KHz | -- | 18 | -- | mΩ | |
| Output Short Circuit Current | Ios | Tj=25°C | -- | 350 | -- | mA | |
| Peak Output Current | I _{o peak} | Tj=25°C | -- | 2.2 | -- | A | |
| Temperature Coefficient of Output Voltage | Δ Vout/Δ Tj | Iout=5mA, 0°C ≤ Tj ≤ 125°C | -- | -1.0 | -- | mV/°C | |

• LM7815 ELECTRICAL CHARACTERISTICS

(Vin=23V, Iout=500mA, 0°C ≤ Tj ≤ 125°C, Cin=0.33μF, Cout=0.1μF; unless otherwise specified.)

| Item | Symbol | Test Conditions | min. | typ. | max. | unit | |
|---|---------------------|--|----------------------|------|-------|-------|----|
| Output Voltage | Vout | Tj=25°C | 14.7 | 15.0 | 15.3 | V | |
| | | 17.5V ≤ Vin ≤ 30V, 5mA ≤ Iout ≤ 1.0A, P _D ≤ 15W | 14.55 | -- | 15.45 | V | |
| Line Regulation | Δ REGline | Tj=25°C | 17.5V ≤ Vin ≤ 30V | -- | 11 | 300 | mV |
| | | | 20V ≤ Vin ≤ 26V | -- | 3.0 | 150 | mV |
| Load Regulation | Δ REGload | Tj=25°C | 5mA ≤ Iout ≤ 1.5A | -- | 12 | 300 | mV |
| | | | 250mA ≤ Iout ≤ 750mA | -- | 4 | 150 | mV |
| Quiescent Current | Iq | Tj=25°C, Iout=0 | -- | 4.4 | 8.0 | mA | |
| Quiescent Current Change | Δ Iq | Tj=25°C | 17.5V ≤ Vin ≤ 30V | -- | -- | 1.0 | mA |
| | | | 5mA ≤ Iout ≤ 1.0A | -- | -- | 0.5 | mA |
| Output Noise Voltage | Vn | Ta=25°C, 10Hz ≤ f ≤ 100KHz | -- | 90 | -- | μV | |
| Ripple Rejection Ratio | RR | f=120Hz | 54 | 70 | -- | dB | |
| Voltage Drop | Vdrop | Iout=1.0A, Tj=25°C | -- | 2.0 | -- | V | |
| Output Resistance | Rout | f=1KHz | -- | 19 | -- | mΩ | |
| Output Short Circuit Current | Ios | Tj=25°C | -- | 230 | -- | mA | |
| Peak Output Current | I _{o peak} | Tj=25°C | -- | 2.1 | -- | A | |
| Temperature Coefficient of Output Voltage | Δ Vout/Δ Tj | Iout=5mA, 0°C ≤ Tj ≤ 125°C | -- | -1.0 | -- | mV/°C | |

LM7818 ELECTRICAL CHARACTERISTICS

($V_{in}=27V$, $I_{out}=500mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

| Item | Symbol | Test Conditions | min. | typ. | max. | unit | |
|---|--------------|--|----------------------|------|-------|-------|----|
| Output Voltage | Vout | Tj=25°C | 17.64 | 18.0 | 18.36 | V | |
| | | 21.0V ≤ Vin ≤ 33V, 5mA ≤ Iout ≤ 1.0A, Pd ≤ 15W | 17.44 | -- | 18.56 | V | |
| Line Regulation | Δ Vo line | Tj=25°C | 21.0V ≤ Vin ≤ 33V | -- | 15 | 360 | mV |
| | | | 24V ≤ Vin ≤ 30V | -- | 5.0 | 180 | mV |
| Load Regulation | Δ REGload | Tj=25°C | 5mA ≤ Iout ≤ 1.5A | -- | 12 | 360 | mV |
| | | | 250mA ≤ Iout ≤ 750mA | -- | 4.0 | 180 | mV |
| Quiescent Current | Iq | Tj=25°C, Iout=0 | | -- | 4.5 | 8.0 | mA |
| | | | 21.0V ≤ Vin ≤ 33V | -- | -- | 1.0 | mA |
| Quiescent Current Change | Δ Iq | 5mA ≤ Iout ≤ 1.0A | -- | -- | 0.5 | mA | |
| Output Noise Voltage | Vn | Ta=25°C, 10Hz ≤ f ≤ 100KHz | -- | 110 | -- | μ V | |
| Ripple Rejection Ratio | RR | f=120Hz | 53 | 69 | -- | dB | |
| Voltage Drop | Vdrop | Iout=1.0A, Tj=25°C | -- | 2.0 | -- | V | |
| Output Resistance | Rout | f=1KHz | -- | 22 | -- | mΩ | |
| Output Short Circuit Current | Ios | Tj=25°C | -- | 200 | -- | mA | |
| Peak Output Current | Io peak | Tj=25°C | -- | 2.1 | -- | A | |
| Temperature Coefficient of Output Voltage | Δ Vout/ Δ Tj | Iout=5mA, 0°C ≤ Tj ≤ 125°C | -- | -1.0 | -- | mV/°C | |

LM7824 ELECTRICAL CHARACTERISTICS

($V_{in}=33V$, $I_{out}=500mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

| Item | Symbol | Test Conditions | min. | typ. | max. | unit | |
|---|--------------|--|----------------------|------|-------|-------|----|
| Output Voltage | Vout | Tj=25°C | 23.52 | 24.0 | 24.48 | V | |
| | | 27.0V ≤ Vin ≤ 38V, 5mA ≤ Iout ≤ 1.0A, Pd ≤ 15W | 23.32 | -- | 24.68 | V | |
| Line Regulation | Δ Vo line | Tj=25°C | 27.0V ≤ Vin ≤ 38V | -- | 18 | 480 | mV |
| | | | 30V ≤ Vin ≤ 36V | -- | 6.0 | 240 | mV |
| Load Regulation | Δ Vo load | Tj=25°C | 5mA ≤ Iout ≤ 1.5A | -- | 12 | 480 | mV |
| | | | 250mA ≤ Iout ≤ 750mA | -- | 4.0 | 240 | mV |
| Quiescent Current | Iq | Tj=25°C, Iout=0 | | -- | 4.6 | 8.0 | mA |
| | | | 27.0V ≤ Vin ≤ 38V | -- | -- | 1.0 | mA |
| Quiescent Current Change | Δ Iq | 5mA ≤ Iout ≤ 1.0A | -- | -- | 0.5 | mA | |
| Output Noise Voltage | Vn | Ta=25°C, 10Hz ≤ f ≤ 100KHz | -- | 170 | -- | μ V | |
| Ripple Rejection Ratio | RR | f=120Hz | 50 | 66 | -- | dB | |
| Voltage Drop | Vdrop | Iout=1.0A, Tj=25°C | -- | 2.0 | -- | V | |
| Output Resistance | Rout | f=1KHz | -- | 28 | -- | mΩ | |
| Output Short Circuit Current | Ios | Tj=25°C | -- | 150 | -- | mA | |
| Peak Output Current | Io peak | Tj=25°C | -- | 2.1 | -- | A | |
| Temperature Coefficient of Output Voltage | Δ Vout/ Δ Tj | Iout=5mA, 0°C ≤ Tj ≤ 125°C | -- | -1.5 | -- | mV/°C | |

FIGURE 1 - WORST CASE POWER DISSIPATION versus AMBIENT TEMPERATURE (Case 221A)

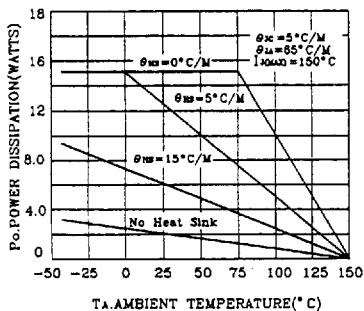


FIGURE 2 - WORST CASE POWER DISSIPATION versus AMBIENT TEMPERATURE (Case 1)

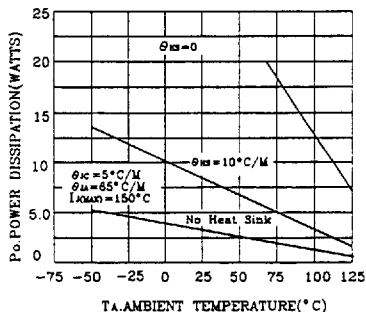


FIGURE 3 - INPUT OUTPUT DIFFERENTIAL AS A FUNCTION OF JUNCTION TEMPERATURE

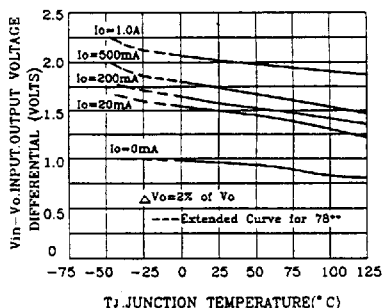


FIGURE 4 - INPUT OUTPUT DIFFERENTIAL AS A FUNCTION OF JUNCTION TEMPERATURE

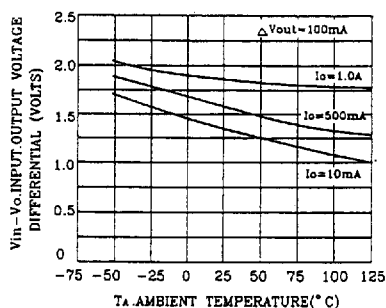


FIGURE 5 - PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE

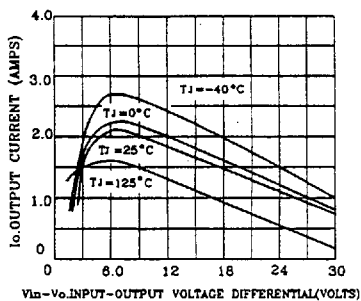


FIGURE 6 - PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE

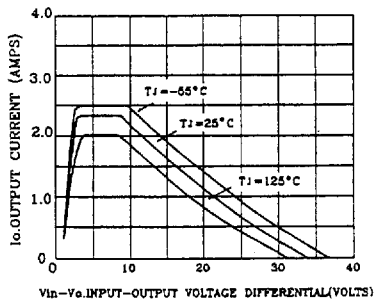


FIGURE 7 - RIPPLE REJECTION AS A FUNCTION OF OUTPUT VOLTAGE

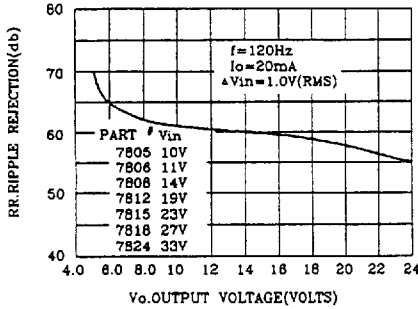


FIGURE 8 - RIPPLE REJECTION AS A FUNCTION OF FREQUENCY

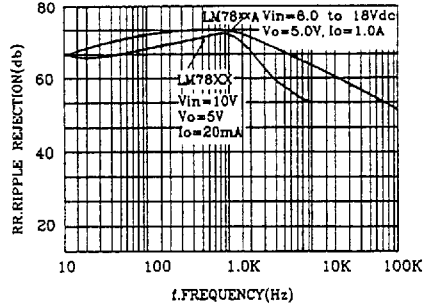


FIGURE 9 - OUTPUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

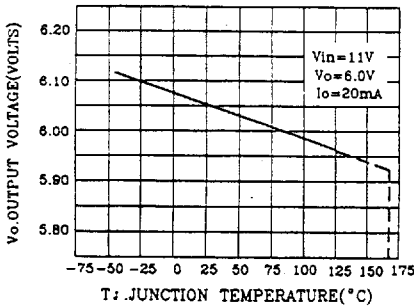


FIGURE 10 - OUTPUT IMPEDANCE AS A FUNCTION OF OUTPUT VOLTAGE

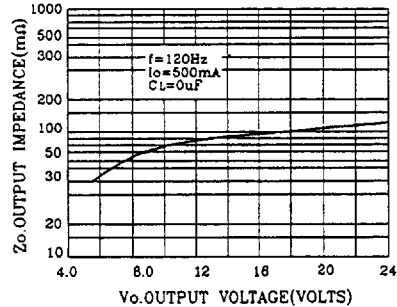


FIGURE 11 - QUIESCENT CURRENT AS A FUNCTION OF TEMPERATURE

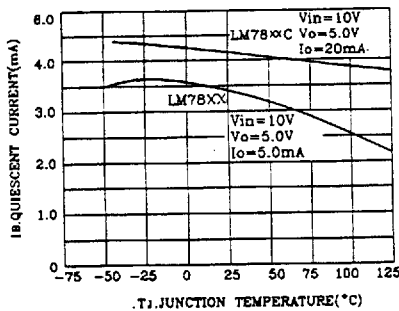


FIGURE 12 - DROPOUT CHARACTERISTICS

