

### 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

## 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

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.

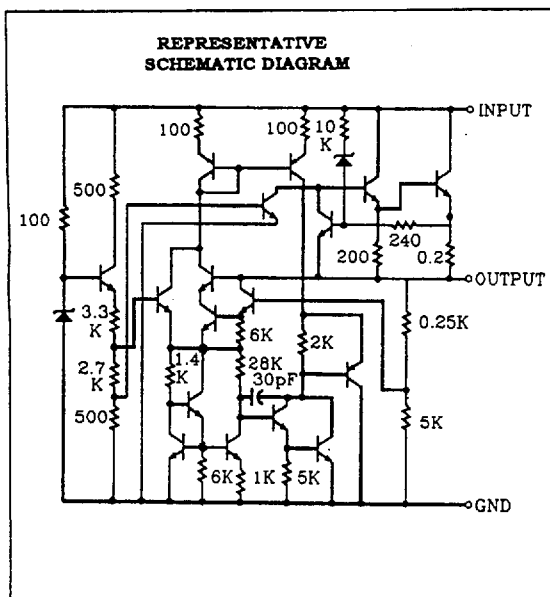
### PIN ARRANGEMENT



PIN 1. INPUT  
2. GROUND  
3. OUTPUT

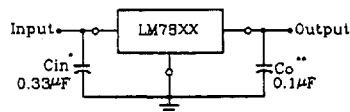
(Heatsink  
surface connected  
to Pin 2.)

### CIRCUIT SCHEMATIC



### TYPICAL CONNECTING CIRCUIT

## STANDARD APPLICATION



A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0V above the output voltage even during the low point on the input ripple voltage.

XX = these two digits of the type number indicate voltage.

\* =Cin is required if regulator is located at a distance from power supply filter.

\*\* = Co is not needed for stability; however, it does improve transient response.

**• ABSOLUTE MAXIMUM RATINGS (Ta=25°C)**

Item	Symbol	LM7800 Series	Unit
Input Voltage	Vin *	30	V
Input Voltage	Vin **	40	V
Power Dissipation	P <sub>D</sub> ***	15	W
Operating Ambient Temperature	Topr	-20 to +75	°C
Operating Junction Temperature	Tj	-20 to +125	°C
Storage Temperature	Tstg	-55 to +125	°C

**Note:** \*LM7805 to LM7818

\*\* LM7824

\*\*\*Follow the derating curve

**• LM7805 ELECTRICAL CHARACTERISTICS**

(Vin=10V, 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	4.90	5.0	5.10	V
		7V ≤ Vin ≤ 20V, 5mA ≤ Iout ≤ 1.0A, P <sub>D</sub> ≤ 15W	4.85	--	5.15	V
Line Regulation	REGline	Tj=25°C	7V ≤ Vin ≤ 25V	--	3	100 mV
			8V ≤ Vin ≤ 12V	--	1	50 mV
			5mA ≤ Iout ≤ 1.5A	--	15	100 mV
Load Regulation	REGload	Tj=25°C	250mA ≤ Iout ≤ 750mA	--	5	50 mV
Quiescent Current	Iq	Tj=25°C, Iout=0	--	4.2	8.0	mA
Quiescent Current Change	Δ Iq	7V ≤ Vin ≤ 25V	--	--	1.3	mA
		5mA ≤ Iout ≤ 1.0A	--	--	0.5	mA
Output Noise Voltage	Vn	Ta=25°C, 10Hz ≤ f ≤ 100KHz	--	40	--	μV
Ripple Rejection Ratio	RR	f=120Hz	62	78	--	dB
Voltage Drop	Vdrop	Iout=1.0A, Tj=25°C	--	2.0	--	V
Output Resistance	Rout	f=1KHz	--	17	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C	--	750	--	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	--	-1.1	--	mV/°C

**LM7806 ELECTRICAL CHARACTERISTICS**

( $V_{in}=11V$ ,  $I_{out}=500mA$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ ,  $C_{in}=0.33\mu F$ ,  $C_{out}=0.1\mu F$ ; unless otherwise specified.)

Item	Symbol	Test Conditions	min.	typ.	max.	unit
Output Voltage	$V_{out}$	$T_j=25^{\circ}C$	5.88	6.0	6.12	V
		$8V \leq V_{in} \leq 21V$ , $5mA \leq I_{out} \leq 1.0A$ , $P_D \leq 15W$	5.83	--	6.17	V
Line Regulation	$\Delta REG_{line}$	$T_j=25^{\circ}C$				
		$8V \leq V_{in} \leq 25V$	--	5	120	mV
Load Regulation	$\Delta REG_{load}$	$T_j=25^{\circ}C$				
		$5mA \leq I_{out} \leq 1.5A$	--	14	120	mV
Quiescent Current	$I_q$	$T_j=25^{\circ}C$ , $I_{out}=0$	--	4.3	8.0	mA
Quiescent Current Change	$\Delta I_q$	$8V \leq V_{in} \leq 25V$	--	--	1.3	mA
		$5mA \leq I_{out} \leq 1.0A$	--	--	0.5	mA
Output Noise Voltage	$V_n$	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100KHz$	--	45	--	$\mu V$
Ripple Rejection Ratio	RR	$f=120Hz$	59	75	--	dB
Voltage Drop	$V_{drop}$	$I_{out}=1.0A$ , $T_j=25^{\circ}C$	--	2.0	--	V
Output Resistance	$R_{out}$	$f=1KHz$	--	19	--	$m\Omega$
Output Short Circuit Current	$I_{os}$	$T_j=25^{\circ}C$	--	550	--	mA
Peak Output Current	$I_{o peak}$	$T_j=25^{\circ}C$	--	2.2	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_j$	$I_{out}=5mA$ , $0^{\circ}C \leq T_j \leq 125^{\circ}C$	--	-0.8	--	mV/ $^{\circ}C$

**LM7808 ELECTRICAL CHARACTERISTICS**

( $V_{in}=14V$ ,  $I_{out}=500mA$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ ,  $C_{in}=0.33\mu F$ ,  $C_{out}=0.1\mu F$ ; unless otherwise specified.)

Item	Symbol	Test Conditions	min.	typ.	max.	unit
Output Voltage	$V_{out}$	$T_j=25^{\circ}C$	7.84	8.0	8.16	V
		$10.5V \leq V_{in} \leq 23V$ , $5mA \leq I_{out} \leq 1.0A$ , $P_D \leq 15W$	7.74	--	8.26	V
Line Regulation	$\Delta REG_{line}$	$T_j=25^{\circ}C$				
		$10.5V \leq V_{in} \leq 25V$	--	6	160	mV
Load Regulation	$\Delta REG_{load}$	$T_j=25^{\circ}C$				
		$5mA \leq I_{out} \leq 1.5A$	--	12	160	mV
Quiescent Current	$I_q$	$T_j=25^{\circ}C$ , $I_{out}=0$	--	4.3	8.0	mA
Quiescent Current Change	$\Delta I_q$	$10.5V \leq V_{in} \leq 25V$	--	--	1.0	mA
		$5mA \leq I_{out} \leq 1.0A$	--	--	0.5	mA
Output Noise Voltage	$V_n$	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100KHz$	--	52	--	$\mu V$
Ripple Rejection Ratio	RR	$f=120Hz$	56	72	--	dB
Voltage Drop	$V_{drop}$	$I_{out}=1.0A$ , $T_j=25^{\circ}C$	--	2.0	--	V
Output Resistance	$R_{out}$	$f=1KHz$	--	16	--	$m\Omega$
Output Short Circuit Current	$I_{os}$	$T_j=25^{\circ}C$	--	450	--	mA
Peak Output Current	$I_{o peak}$	$T_j=25^{\circ}C$	--	2.2	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_j$	$I_{out}=5mA$ , $0^{\circ}C \leq T_j \leq 125^{\circ}C$	--	-1.8	--	mV/ $^{\circ}C$

**• LM7809 ELECTRICAL CHARACTERISTICS**

( $V_{in}=15V$ ,  $I_{out}=500mA$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ ,  $C_{in}=0.33\mu F$ ,  $C_{out}=0.1\mu F$ ; unless otherwise specified.)

Item	Symbol	Test Conditions	min.	typ.	max.	unit
Output Voltage	$V_{out}$	$T_j=25^{\circ}C$	8.82	9	9.18	V
		$10.5V \leq V_{in} \leq 27V$ , $5mA \leq I_{out} \leq 1.0A$ , $P_D \leq 15W$	8.77	--	9.23	V
Line Regulation	$\Delta RE_{Gline}$	$T_j=25^{\circ}C$				
		$11.5V \leq V_{in} \leq 30V$	--	6	160	mV
Load Regulation	$\Delta RE_{Gload}$	$T_j=25^{\circ}C$				
		$12V \leq V_{in} \leq 18V$	--	2.0	80	mV
Quiescent Current	$I_q$	$T_j=25^{\circ}C$				
		$5mA \leq I_{out} \leq 1.5A$	--	12	160	mV
Quiescent Current Change	$\Delta I_q$	$T_j=25^{\circ}C$				
		$250mA \leq I_{out} \leq 750mA$	--	4	80	mV
Output Noise Voltage	$V_n$	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100KHz$	--	52	--	$\mu V$
Ripple Rejection Ratio	RR	$f=120Hz$	55	72	--	dB
Voltage Drop	$V_{drop}$	$I_{out}=1.0A$ , $T_j=25^{\circ}C$	--	2.0	--	V
Output Resistance	$R_{out}$	$f=1KHz$	--	16	--	$m\Omega$
Output Short Circuit Current	$I_{os}$	$T_j=25^{\circ}C$	--	450	--	mA
Peak Output Current	$I_{o peak}$	$T_j=25^{\circ}C$	--	2.2	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_j$	$I_{out}=5mA$ , $0^{\circ}C \leq T_j \leq 125^{\circ}C$	--	-1.8	--	mV/ $^{\circ}C$

**• LM7810 ELECTRICAL CHARACTERISTICS**

( $V_{in}=16V$ ,  $I_{out}=500mA$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ ,  $C_{in}=0.33\mu F$ ,  $C_{out}=0.1\mu F$ ; unless otherwise specified.)

Item	Symbol	Test Conditions	min.	typ.	max.	unit
Output Voltage	$V_{out}$	$T_j=25^{\circ}C$	9.8	10	10.2	V
		$17.5V \leq V_{in} \leq 30V$ , $5mA \leq I_{out} \leq 1.0A$ , $P_D \leq 15W$	9.75	-	12.25	V
Line Regulation	$\Delta RE_{Gline}$	$T_j=25^{\circ}C$				
		$10.5V \leq V_{in} \leq 30V$	--	10	240	mV
Load Regulation	$\Delta RE_{Gload}$	$T_j=25^{\circ}C$				
		$13V \leq V_{in} \leq 9V$	--	3.0	120	mV
Quiescent Current	$I_q$	$T_j=25^{\circ}C$				
		$5mA \leq I_{out} \leq 1.5A$	--	12	240	mV
Quiescent Current Change	$\Delta I_q$	$T_j=25^{\circ}C$				
		$250mA \leq I_{out} \leq 750mA$	--	4.0	120	mV
Output Noise Voltage	$V_n$	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100KHz$	--	52	--	$\mu V$
Ripple Rejection Ratio	RR	$f=120Hz$	54	72	--	dB
Voltage Drop	$V_{drop}$	$I_{out}=1.0A$ , $T_j=25^{\circ}C$	--	2.0	--	V
Output Resistance	$R_{out}$	$f=1KHz$	--	16	--	$m\Omega$
Output Short Circuit Current	$I_{os}$	$T_j=25^{\circ}C$	--	450	--	mA
Peak Output Current	$I_{o peak}$	$T_j=25^{\circ}C$	--	2.2	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_j$	$I_{out}=5mA$ , $0^{\circ}C \leq T_j \leq 125^{\circ}C$	--	-1.8	--	mV/ $^{\circ}C$

**• LM7812 ELECTRICAL CHARACTERISTICS**

( $V_{in}=19V$ ,  $I_{out}=500mA$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ ,  $C_{in}=0.33\mu F$ ,  $C_{out}=0.1\mu F$ ; unless otherwise specified.)

Item	Symbol	Test Conditions	min.	typ.	max.	unit
Output Voltage	$V_{out}$	$T_j=25^{\circ}C$	11.76	12.0	12.24	V
		$14.5V \leq V_{in} \leq 27V$ , $5mA \leq I_{out} \leq 1.0A$ , $P_D \leq 15W$	11.66	--	12.34	V
Line Regulation	$\Delta REG_{line}$	$T_j=25^{\circ}C$				
		$14.5V \leq V_{in} \leq 30V$	--	10	240	mV
Load Regulation	$\Delta REG_{load}$	$T_j=25^{\circ}C$				
		$16V \leq V_{in} \leq 22V$	--	3.0	120	mV
Quiescent Current	$I_q$	$T_j=25^{\circ}C$				
		$5mA \leq I_{out} \leq 1.5A$	--	12	240	mV
Quiescent Current Change	$\Delta I_q$	$T_j=25^{\circ}C$				
		$250mA \leq I_{out} \leq 750mA$	--	4.0	120	mV
Output Noise Voltage	$V_n$	$T_j=25^{\circ}C$ , $I_{out}=0$	--	4.3	8.0	mA
Ripple Rejection Ratio	RR	$14.5V \leq V_{in} \leq 30V$	--	--	1.0	mA
Voltage Drop	$V_{drop}$	$5mA \leq I_{out} \leq 1.0A$	--	--	0.5	mA
Output Resistance	$R_{out}$	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100KHz$	--	75	--	$\mu V$
Output Short Circuit Current	$I_{os}$	$f=120Hz$	55	71	--	dB
Peak Output Current	$I_{o peak}$	$I_{out}=1.0A$ , $T_j=25^{\circ}C$	--	2.0	--	V
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_j$	$f=1KHz$	--	18	--	$m\Omega$
		$T_j=25^{\circ}C$	--	350	--	mA
		$T_j=25^{\circ}C$	--	2.2	--	A
		$I_{out}=5mA$ , $0^{\circ}C \leq T_j \leq 125^{\circ}C$	--	-1.0	--	$mV/^{\circ}C$

**• LM7815 ELECTRICAL CHARACTERISTICS**

( $V_{in}=23V$ ,  $I_{out}=500mA$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ ,  $C_{in}=0.33\mu F$ ,  $C_{out}=0.1\mu F$ ; unless otherwise specified.)

Item	Symbol	Test Conditions	min.	typ.	max.	unit
Output Voltage	$V_{out}$	$T_j=25^{\circ}C$	14.7	15.0	15.3	V
		$17.5V \leq V_{in} \leq 30V$ , $5mA \leq I_{out} \leq 1.0A$ , $P_D \leq 15W$	14.55	--	15.45	V
Line Regulation	$\Delta REG_{line}$	$T_j=25^{\circ}C$				
		$17.5V \leq V_{in} \leq 30V$	--	11	300	mV
Load Regulation	$\Delta REG_{load}$	$T_j=25^{\circ}C$				
		$20V \leq V_{in} \leq 26V$	--	3.0	150	mV
Quiescent Current	$I_q$	$T_j=25^{\circ}C$				
		$5mA \leq I_{out} \leq 1.5A$	--	12	300	mV
Quiescent Current Change	$\Delta I_q$	$T_j=25^{\circ}C$				
		$250mA \leq I_{out} \leq 750mA$	--	4	150	mV
Output Noise Voltage	$V_n$	$T_j=25^{\circ}C$ , $I_{out}=0$	--	4.4	8.0	mA
Ripple Rejection Ratio	RR	$17.5V \leq V_{in} \leq 30V$	--	--	1.0	mA
Voltage Drop	$V_{drop}$	$5mA \leq I_{out} \leq 1.0A$	--	--	0.5	mA
Output Resistance	$R_{out}$	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100KHz$	--	90	--	$\mu V$
Output Short Circuit Current	$I_{os}$	$f=120Hz$	54	70	--	dB
Peak Output Current	$I_{o peak}$	$I_{out}=1.0A$ , $T_j=25^{\circ}C$	--	2.0	--	V
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_j$	$f=1KHz$	--	19	--	$m\Omega$
		$T_j=25^{\circ}C$	--	230	--	mA
		$T_j=25^{\circ}C$	--	2.1	--	A
		$I_{out}=5mA$ , $0^{\circ}C \leq T_j \leq 125^{\circ}C$	--	-1.0	--	$mV/^{\circ}C$

**• 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.)

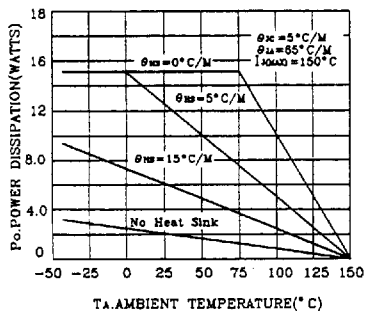
Item	Symbol	Test Conditions	min.	typ.	max.	unit
Output Voltage	$V_{out}$	$T_j=25^{\circ}C$	17.64	18.0	18.36	V
		$21.0V \leq V_{in} \leq 33V$ , $5mA \leq I_{out} \leq 1.0A$ , $P_D \leq 15W$	17.44	--	18.56	V
Line Regulation	$\Delta V_o \text{ line}$	$T_j=25^{\circ}C$	--	15	360	mV
		$21.0V \leq V_{in} \leq 33V$	--	5.0	180	mV
Load Regulation	$\Delta \text{REGload}$	$T_j=25^{\circ}C$	--	12	360	mV
		$5mA \leq I_{out} \leq 1.5A$	--	4.0	180	mV
Quiescent Current	$I_q$	$T_j=25^{\circ}C$ , $I_{out}=0$	--	4.5	8.0	mA
Quiescent Current Change	$\Delta I_q$	$21.0V \leq V_{in} \leq 33V$	--	--	1.0	mA
		$5mA \leq I_{out} \leq 1.0A$	--	--	0.5	mA
Output Noise Voltage	$V_n$	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100KHz$	--	110	--	$\mu V$
Ripple Rejection Ratio	RR	$f=120Hz$	53	69	--	dB
Voltage Drop	$V_{drop}$	$I_{out}=1.0A$ , $T_j=25^{\circ}C$	--	2.0	--	V
Output Resistance	$R_{out}$	$f=1KHz$	--	22	--	$m\Omega$
Output Short Circuit Current	$I_{os}$	$T_j=25^{\circ}C$	--	200	--	mA
Peak Output Current	$I_{o \text{ peak}}$	$T_j=25^{\circ}C$	--	2.1	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out} / \Delta T_j$	$I_{out}=5mA$ , $0^{\circ}C \leq T_j \leq 125^{\circ}C$	--	-1.0	--	$mV/^{\circ}C$

**• LM7824 ELECTRICAL CHARACTERISTICS**

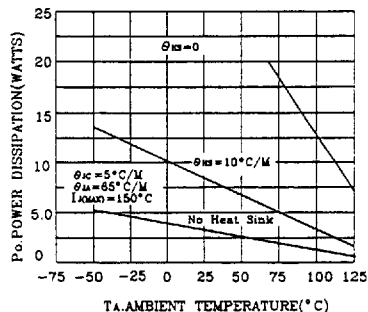
( $V_{in}=33V$ ,  $I_{out}=500mA$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ ,  $C_{in}=0.33\mu F$ ,  $C_{out}=0.1\mu F$ ; unless otherwise specified.)

Item	Symbol	Test Conditions	min.	typ.	max.	unit
Output Voltage	$V_{out}$	$T_j=25^{\circ}C$	23.52	24.0	24.48	V
		$27.0V \leq V_{in} \leq 38V$ , $5mA \leq I_{out} \leq 1.0A$ , $P_D \leq 15W$	23.32	--	24.68	V
Line Regulation	$\Delta V_o \text{ line}$	$T_j=25^{\circ}C$	--	18	480	mV
		$27.0V \leq V_{in} \leq 38V$	--	6.0	240	mV
Load Regulation	$\Delta V_o \text{ load}$	$T_j=25^{\circ}C$	--	12	480	mV
		$5mA \leq I_{out} \leq 1.5A$	--	4.0	240	mV
Quiescent Current	$I_q$	$T_j=25^{\circ}C$ , $I_{out}=0$	--	4.6	8.0	mA
Quiescent Current Change	$\Delta I_q$	$27.0V \leq V_{in} \leq 38V$	--	--	1.0	mA
		$5mA \leq I_{out} \leq 1.0A$	--	--	0.5	mA
Output Noise Voltage	$V_n$	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100KHz$	--	170	--	$\mu V$
Ripple Rejection Ratio	RR	$f=120Hz$	50	66	--	dB
Voltage Drop	$V_{drop}$	$I_{out}=1.0A$ , $T_j=25^{\circ}C$	--	2.0	--	V
Output Resistance	$R_{out}$	$f=1KHz$	--	28	--	$m\Omega$
Output Short Circuit Current	$I_{os}$	$T_j=25^{\circ}C$	--	150	--	mA
Peak Output Current	$I_{o \text{ peak}}$	$T_j=25^{\circ}C$	--	2.1	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out} / \Delta T_j$	$I_{out}=5mA$ , $0^{\circ}C \leq T_j \leq 125^{\circ}C$	--	-1.5	--	$mV/^{\circ}C$

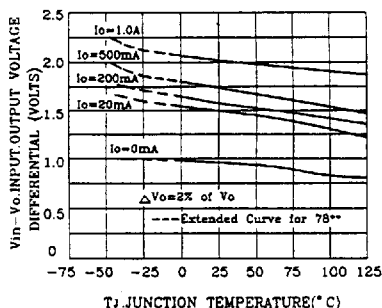
**FIGURE 1 - WORST CASE POWER DISSIPATION  
versus AMBIENT TEMPERATURE (Case 221A)**



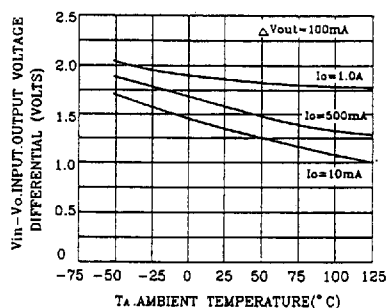
**FIGURE 2 - WORST CASE POWER DISSIPATION  
versus AMBIENT TEMPERATURE (Case 1)**



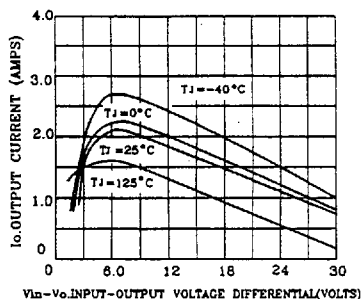
**FIGURE 3 - INPUT OUTPUT DIFFERENTIAL AS A  
FUNCTION OF JUNCTION TEMPERATURE**



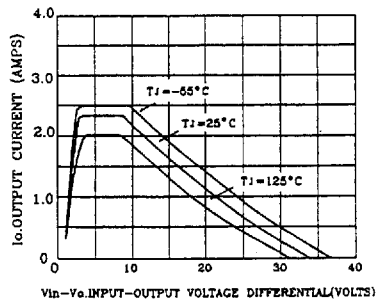
**FIGURE 4 - INPUT OUTPUT DIFFERENTIAL AS A  
FUNCTION OF JUNCTION TEMPERATURE**



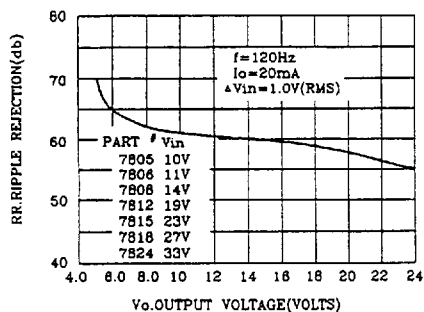
**FIGURE 5 - PEAK OUTPUT CURRENT AS A  
FUNCTION OF INPUT-OUTPUT DIFFERENTIAL  
VOLTAGE**



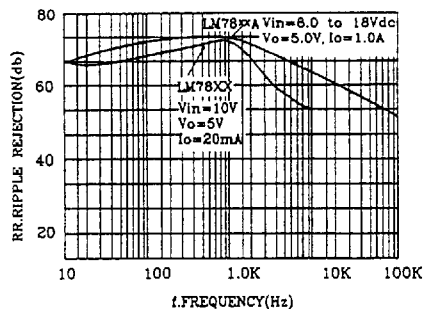
**FIGURE 6 - PEAK OUTPUT CURRENT AS A  
FUNCTION OF INPUT-OUTPUT DIFFERENTIAL  
VOLTAGE**



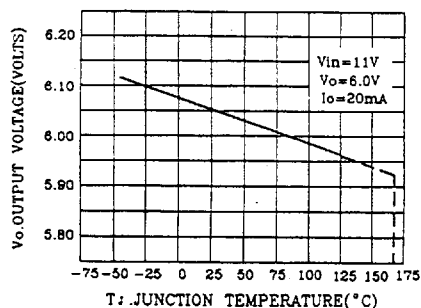
**FIGURE 7 - RIPPLE REJECTION AS A FUNCTION OF OUTPUT VOLTAGE**



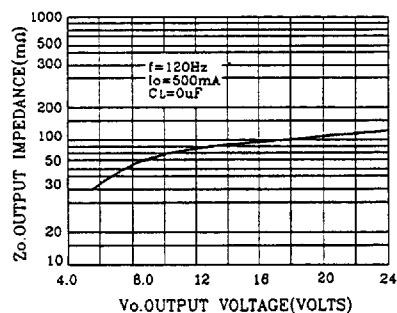
**FIGURE 8 - RIPPLE REJECTION AS A FUNCTION OF FREQUENCY**



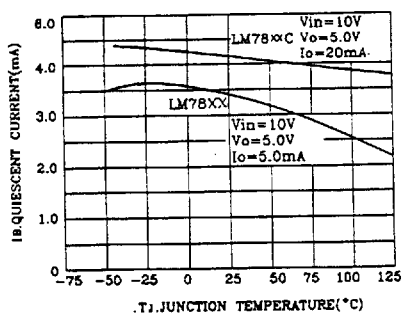
**FIGURE 9 - OUTPUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE**



**FIGURE 10 - OUTPUT IMPEDANCE AS A FUNCTION OF OUTPUT VOLTAGE**



**FIGURE 11 - QUIESCENT CURRENT AS A FUNCTION OF TEMPERATURE**



**FIGURE 12 - DROPOUT CHARACTERISTICS**

