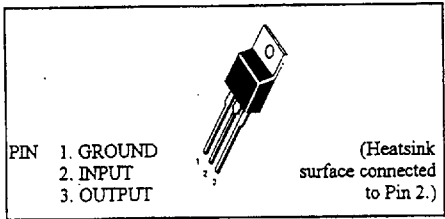


## FEATURES

- No External Components Required
- Internal Thermal Overload Protection
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation
- Available in 2% Voltage Tolerance (See Ordering Information)

## PIN ARRANGEMENT

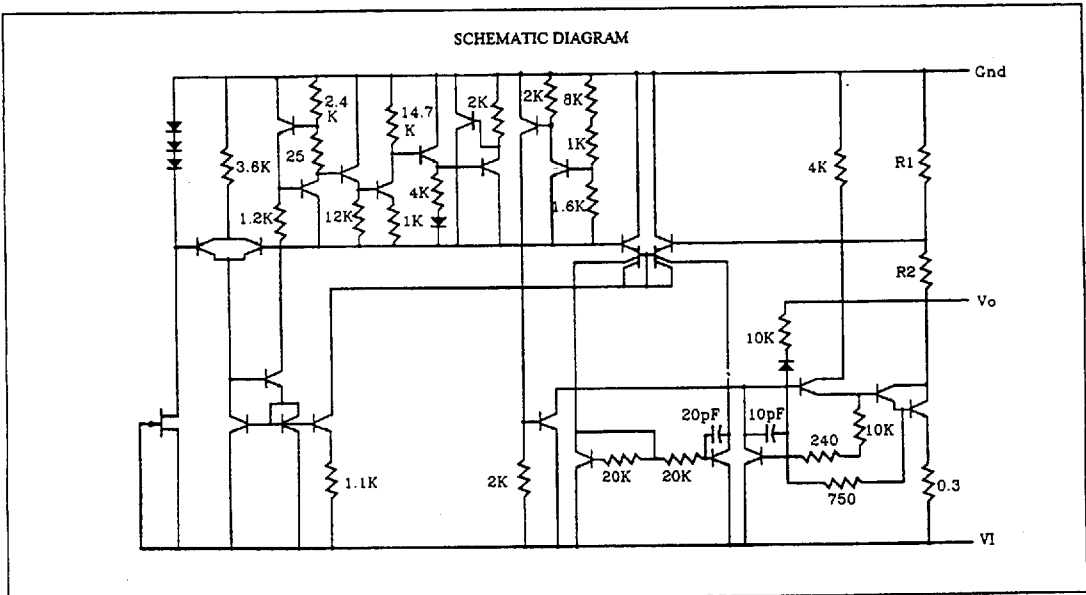


## THREE-TERMINAL NEGATIVE VOLTAGE REGULATORS

The LM7900 Series of fixed output negative voltage regulators are intended as complements to the popular LM7800 Series devices. These negative regulators are available in the same seven-voltage options as the LM7800 devices. In addition, one extra voltage option commonly employed in MECL systems is also available in the negative LM7900 Series.

Available in fixed output voltage options from -5.0 to -24 volts, these regulators employ current limiting, thermal shutdown, and safe-area compensation—making them remarkably rugged under most operating conditions. With adequate heatsinking they can deliver output currents in excess of 1.5 ampere.

## CIRCUIT SCHEMATIC



## ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Item	Symbol	LM7900 Series	Unit
Input Voltage	Vin *1	-30	V
Input Voltage	Vin *2	-40	V
Power Dissipation	P <sub>D</sub> *3	15	W
Operating Ambient Temperature	T <sub>opr</sub>	-20 to +75	°C
Operating Junction Temperature	T <sub>j</sub>	-20 to +125	°C
Storage Temperature	T <sub>stg</sub>	-55 to +125	°C

Note: \*1: LM7905, LM7906, LM7908, LM7909, LM7912, LM7915, LM7918

\*2: LM7924

\*3: Follow the derating curve. When T<sub>j</sub> exceeds 150°C, the internal circuit cuts off the output.

## LM7905 ELECTRICAL CHARACTERISTICS

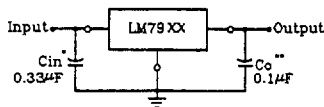
(V<sub>in</sub>=-10V, I<sub>out</sub>=500mA, C<sub>in</sub>=2μF, C<sub>out</sub>=1μF; T<sub>j</sub>=0°C to 125°C, unless otherwise specified.)

Item	Symbol	Test Circuit	Condition	Min.	Typ.	Max.	Unit	
Output Voltage	V <sub>o</sub>	1	T <sub>j</sub> =25°C	-4.9	-5.0	-5.1	V	
Output Voltage Tolerance	V <sub>o</sub>	1	V <sub>i</sub> =-7 to -20V, I <sub>o</sub> =5mA to 1A, P <sub>D</sub> <15W	-4.85	-	-5.15	V	
Line Regulation	REG <sub>line</sub>	1	T <sub>j</sub> =25°C	V <sub>i</sub> =-7 to -25V	-	3	100	mV
				V <sub>i</sub> =-8 to -12V	-	1	50	mV
Load Regulation	REG <sub>load</sub>	1	T <sub>j</sub> =25°C	I <sub>o</sub> =5mA to 1.5A	-	10	100	mV
				I <sub>o</sub> =250mA to 750mA	-	3	50	mV
Bias Current	I <sub>IB</sub>	2	T <sub>j</sub> =25°C	-	2	4	mA	
Input Bias Current Fluctuation	Δ I <sub>IB</sub> Input	2	V <sub>i</sub> =-7 to -25V, T <sub>j</sub> =25°C	-	-	1.3	mA	
Load Bias Current Fluctuation	Δ I <sub>IB</sub> Load	2	I <sub>o</sub> =5mA to 1A, T <sub>j</sub> =25°C	-	-	0.5	mA	
Output Noise Voltage	V <sub>n</sub>	1	f=10Hz to 100KHz, T <sub>a</sub> =25°C	-	40	-	μV	
Ripple Rejection Ratio	RR	3	V <sub>i</sub> =-8 to -18V, I <sub>o</sub> =100mA, f=120Hz	62	74	-	dB	
Min. I/O Voltage Difference	V <sub>dif</sub>		I <sub>o</sub> =1A, T <sub>j</sub> =25°C	-	1.1	-	V	
Peak Output Current	I <sub>o</sub> -peak	1	T <sub>j</sub> =25°C	-	2.1	-	A	
Output Voltage Temperature Coefficient	Δ V <sub>o</sub> /T <sub>a</sub>	1	I <sub>o</sub> =5mA, T <sub>j</sub> =0 to 125°C	-	-0.4	-	mV/°C	

Note: The specified condition T<sub>j</sub>=25°C means that the test should be carried out with the test time so short (within 10mS), that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

## TYPICAL CONNECTING CIRCUIT

### STANDARD APPLICATION



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

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

\* = C<sub>in</sub> is required if regulator is located an appreciable distance from power supply filter.

\*\* = C<sub>o</sub> improves stability and transient response.

## LM7906 ELECTRICAL CHARACTERISTICS

( $V_{in} = -11V$ ,  $I_{out} = 500mA$ ,  $C_{in} = 2\mu F$ ,  $C_{out} = 1\mu F$ ;  $T_j = 0^\circ C$  to  $125^\circ C$ , unless otherwise specified.)

Item	Symbol	Test Circuit	Condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	1	$T_j = 25^\circ C$	-5.88	-6	-6.12	V	
Output Voltage Tolerance	$V_o$	1	$V_i = -8$ to $-21V$ , $I_o = 5mA$ to $1A$ , $P_D < 15W$	-5.83	-	-6.17	V	
Line Regulation	REGline	1	$T_j = 25^\circ C$	$V_i = -8$ to $-25V$	-	4	120	mV
				$V_i = -9$ to $-13V$	-	1.5	60	mV
Load Regulation	REGload	1	$T_j = 25^\circ C$	$I_o = 5mA$ to $1.5A$	-	10	120	mV
				$I_o = 250mA$ to $750mA$	-	3	60	mV
Bias Current	$I_{IB}$	2	$T_j = 25^\circ C$	-	2	4	mA	
Input Bias Current Fluctuation	$\Delta I_{IB}$ Input	2	$V_i = -8$ to $-25V$ , $T_j = 25^\circ C$	-	-	1.3	mA	
Load Bias Current Fluctuation	$\Delta I_{IB}$ Load	2	$I_o = 5mA$ to $1A$ , $T_j = 25^\circ C$	-	-	0.5	mA	
Output Noise Voltage	$V_n$	1	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$	-	44	-	$\mu V$	
Ripple Rejection Ratio	RR	3	$V_i = -9$ to $-19V$ , $I_o = 100mA$ , $f = 120Hz$	60	73	-	dB	
Min. I/O Voltage Difference	Vdif		$I_o = 1A$ , $T_j = 25^\circ C$	-	1.1	-	V	
Peak Output Current	$I_o$ -peak	1	$T_j = 25^\circ C$	-	2.1	-	A	
Output Voltage Temperature Coefficient	$\Delta V_o/T_a$	1	$I_o = 5mA$ , $T_j = 0$ to $125^\circ C$	-	-0.5	-	mV/ $^\circ C$	

Note: The specified condition  $T_j = 25^\circ C$  means that the test should be carried out with the test time so short (within 10mS), that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

## LM7908 ELECTRICAL CHARACTERISTICS

( $V_{in} = -14V$ ,  $I_{out} = 500mA$ ,  $C_{in} = 2\mu F$ ,  $C_{out} = 1\mu F$ ;  $T_j = 0^\circ C$  to  $125^\circ C$ , unless otherwise specified.)

Item	Symbol	Test Circuit	Condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	1	$T_j = 25^\circ C$	-7.84	-8	-8.16	V	
Output Voltage Tolerance	$V_o$	1	$V_i = -10.5$ to $-23V$ , $I_o = 5mA$ to $1A$ , $P_D < 15W$	-7.74	-	-8.26	V	
Line Regulation	REGline	1	$T_j = 25^\circ C$	$V_i = -10.5$ to $-25V$	-	6	160	mV
				$V_i = -11$ to $-17V$	-	2	80	mV
Load Regulation	REGload	1	$T_j = 25^\circ C$	$I_o = 5mA$ to $1.5A$	-	12	160	mV
				$I_o = 250mA$ to $750mA$	-	4	80	mV
Bias Current	$I_{IB}$	2	$T_j = 25^\circ C$	-	2.2	4.5	mA	
Input Bias Current Fluctuation	$\Delta I_{IB}$ Input	2	$V_i = -10.5$ to $-25V$ , $T_j = 25^\circ C$	-	-	1	mA	
Load Bias Current Fluctuation	$\Delta I_{IB}$ Load	2	$I_o = 5mA$ to $1A$ , $T_j = 25^\circ C$	-	-	0.5	mA	
Output Noise Voltage	$V_n$	1	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$	-	52	-	$\mu V$	
Ripple Rejection Ratio	RR	3	$V_i = -11$ to $-21V$ , $I_o = 100mA$ , $f = 120Hz$	56	71	-	dB	
Min. I/O Voltage Difference	Vdif		$I_o = 1A$ , $T_j = 25^\circ C$	-	2	-	V	
Peak Output Current	$I_o$ -peak	1	$T_j = 25^\circ C$	-	2.1	-	A	
Output Voltage Temperature Coefficient	$\Delta V_o/T_a$	1	$I_o = 5mA$ , $T_j = 0$ to $125^\circ C$	-	-0.6	-	mV/ $^\circ C$	

Note: The specified condition  $T_j = 25^\circ C$  means that the test should be carried out with the test time so short (within 10mS), that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

## LM7909 ELECTRICAL CHARACTERISTICS

( $V_{in}=-15V$ ,  $I_{out}=500mA$ ,  $C_{in}=2\mu F$ ,  $C_{out}=1\mu F$ ;  $T_j=0^\circ C$  to  $125^\circ C$ , unless otherwise specified.)

Item	Symbol	Test Circuit	Condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	1	$T_j=25^\circ C$	-8.82	-9	-9.18	V	
Output Voltage Tolerance	$V_o$	1	$V_i=-11.5$ to $-24V$ , $I_o=5mA$ to $1A$ , $P_D<15W$	-8.72	-	-9.28	V	
Line Regulation	REGline	1	$T_j=25^\circ C$	$V_i=-11.5$ to $-26V$	-	7	180	mV
				$V_i=-12$ to $-18V$	-	2	90	mV
Load Regulation	REGload	1	$T_j=25^\circ C$	$I_o=5mA$ to $1.5A$	-	12	180	mV
				$I_o=250mA$ to $750mA$	-	4	90	mV
Bias Current	$I_{IB}$	2	$T_j=25^\circ C$	-	2.2	4.5	mA	
Input Bias Current Fluctuation	$\Delta I_{IB}$ Input	2	$V_i=-11.5$ to $-26V$ , $T_j=25^\circ C$	-	-	1	mA	
Load Bias Current Fluctuation	$\Delta I_{IB}$ Load	2	$I_o=5mA$ to $1A$ , $T_j=25^\circ C$	-	-	0.5	mA	
Output Noise Voltage	$V_n$	1	$f=10Hz$ to $100KHz$ , $T_a=25^\circ C$	-	58	-	$\mu V$	
Ripple Rejection Ratio	RR	3	$V_i=-12$ to $-22V$ , $I_o=100mA$ , $f=120Hz$	56	71	-	dB	
Min. I/O Voltage Difference	$V_{dif}$		$I_o=1A$ , $T_j=25^\circ C$	-	1.1	-	V	
Peak Output Current	$I_o$ -peak	1	$T_j=25^\circ C$	-	2.1	-	A	
Output Voltage Temperature Coefficient	$\Delta V_o/T_a$	1	$I_o=5mA$ , $T_j=0$ to $125^\circ C$	-	-0.6	-	mV/ $^\circ C$	

Note: The specified condition  $T_j=25^\circ C$  means that the test should be carried out with the test time so short (within 10ms), that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

## LM7912 ELECTRICAL CHARACTERISTICS

( $V_{in}=-19V$ ,  $I_{out}=500mA$ ,  $C_{in}=2\mu F$ ,  $C_{out}=1\mu F$ ;  $T_j=0^\circ C$  to  $125^\circ C$ , unless otherwise specified.)

Item	Symbol	Test Circuit	Condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	1	$T_j=25^\circ C$	-11.76	-12	-12.24	V	
Output Voltage Tolerance	$V_o$	1	$V_i=-14.5$ to $-27V$ , $I_o=5mA$ to $1A$ , $P_D<15W$	-11.66	-	-12.34	V	
Line Regulation	REGline	1	$T_j=25^\circ C$	$V_i=-14.5$ to $-30V$	-	10	240	mV
				$V_i=-16$ to $-22V$	-	3	120	mV
Load Regulation	REGload	1	$T_j=25^\circ C$	$I_o=5mA$ to $1.5A$	-	12	240	mV
				$I_o=250mA$ to $750mA$	-	4	120	mV
Bias Current	$I_{IB}$	2	$T_j=25^\circ C$	-	2.5	5	mA	
Input Bias Current Fluctuation	$\Delta I_{IB}$ Input	2	$V_i=-14.5$ to $-30V$ , $T_j=25^\circ C$	-	-	1	mA	
Load Bias Current Fluctuation	$\Delta I_{IB}$ Load	2	$I_o=5mA$ to $1A$ , $T_j=25^\circ C$	-	-	0.5	mA	
Output Noise Voltage	$V_n$	1	$f=10Hz$ to $100KHz$ , $T_a=25^\circ C$	-	75	-	$\mu V$	
Ripple Rejection Ratio	RR	3	$V_i=-15$ to $-25V$ , $I_o=100mA$ , $f=120Hz$	55	70	-	dB	
Min. I/O Voltage Difference	$V_{dif}$		$I_o=1A$ , $T_j=25^\circ C$	-	1.1	-	V	
Peak Output Current	$I_o$ -peak	1	$T_j=25^\circ C$	-	2.1	-	A	
Output Voltage Temperature Coefficient	$\Delta V_o/T_a$	1	$I_o=5mA$ , $T_j=0$ to $125^\circ C$	-	-0.8	-	mV/ $^\circ C$	

Note: The specified condition  $T_j=25^\circ C$  means that the test should be carried out with the test time so short (within 10ms), that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

## LM7915 ELECTRICAL CHARACTERISTICS

( $V_{in} = -23V$ ,  $I_{out} = 500mA$ ,  $C_{in} = 2\mu F$ ,  $C_{out} = 1\mu F$ ;  $T_j = 0^\circ C$  to  $125^\circ C$ , unless otherwise specified.)

Item	Symbol	Test Circuit	Condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	1	$T_j = 25^\circ C$	-14.7	-15	-15.3	V	
Output Voltage Tolerance	$V_o$	1	$V_i = -17.5$ to $-30V$ , $I_o = 5mA$ to $1A$ , $P_D < 15W$	-14.55	—	-15.45	V	
Line Regulation	REGline	1	$T_j = 25^\circ C$	$V_i = -17.5$ to $-30V$	—	11	300	mV
				$V_i = -20$ to $-26V$	—	3	150	mV
Load Regulation	REGload	1	$T_j = 25^\circ C$	$I_o = 5mA$ to $1.5A$	—	12	300	mV
				$I_o = 250mA$ to $750mA$	—	4	150	mV
Bias Current	$I_{IB}$	2	$T_j = 25^\circ C$	—	2.5	5	mA	
Input Bias Current Fluctuation	$\Delta I_{IB}$ Input	2	$V_i = -17.5$ to $-30V$ , $T_j = 25^\circ C$	—	—	1	mA	
Load Bias Current Fluctuation	$\Delta I_{IB}$ Load	2	$I_o = 5mA$ to $1A$ , $T_j = 25^\circ C$	—	—	0.5	mA	
Output Noise Voltage	$V_n$	1	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$	—	90	—	$\mu V$	
Ripple Rejection Ratio	RR	3	$V_i = -18.5$ to $-28.5V$ , $I_o = 100mA$ , $f = 120Hz$	54	69	—	dB	
Min. I/O Voltage Difference	$V_{dif}$		$I_o = 1A$ , $T_j = 25^\circ C$	—	1.1	—	V	
Peak Output Current	$I_o$ -peak	1	$T_j = 25^\circ C$	—	2.1	—	A	
Output Voltage Temperature Coefficient	$\Delta V_o/T_a$	1	$I_o = 5mA$ , $T_j = 0$ to $125^\circ C$	—	-0.9	—	mV/ $^\circ C$	

Note: The specified condition  $T_j = 25^\circ C$  means that the test should be carried out with the test time so short (within 10mS), that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

## LM7918 ELECTRICAL CHARACTERISTICS

( $V_{in} = -27V$ ,  $I_{out} = 500mA$ ,  $C_{in} = 2\mu F$ ,  $C_{out} = 1\mu F$ ;  $T_j = 0^\circ C$  to  $125^\circ C$ , unless otherwise specified.)

Item	Symbol	Test Circuit	Condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	1	$T_j = 25^\circ C$	-17.64	-18	-18.36	V	
Output Voltage Tolerance	$V_o$	1	$V_i = -21$ to $-33V$ , $I_o = 5mA$ to $1A$ , $P_D < 15W$	-17.54	—	-18.46	V	
Line Regulation	REGline	1	$T_j = 25^\circ C$	$V_i = -21$ to $-33V$	—	15	360	mV
				$V_i = -24$ to $-30V$	—	5	180	mV
Load Regulation	REGload	1	$T_j = 25^\circ C$	$I_o = 5mA$ to $1.5A$	—	12	360	mV
				$I_o = 250mA$ to $750mA$	—	4	180	mV
Bias Current	$I_{IB}$	2	$T_j = 25^\circ C$	—	2.5	5	mA	
Input Bias Current Fluctuation	$\Delta I_{IB}$ Input	2	$V_i = -21$ to $-33V$ , $T_j = 25^\circ C$	—	—	1	mA	
Load Bias Current Fluctuation	$\Delta I_{IB}$ Load	2	$I_o = 5mA$ to $1A$ , $T_j = 25^\circ C$	—	—	0.5	mA	
Output Noise Voltage	$V_n$	1	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$	—	110	—	$\mu V$	
Ripple Rejection Ratio	RR	3	$V_i = -22$ to $-32V$ , $I_o = 100mA$ , $f = 120Hz$	53	68	—	dB	
Min. I/O Voltage Difference	$V_{dif}$		$I_o = 1A$ , $T_j = 25^\circ C$	—	1.1	—	V	
Peak Output Current	$I_o$ -peak	1	$T_j = 25^\circ C$	—	2.1	—	A	
Output Voltage Temperature Coefficient	$\Delta V_o/T_a$	1	$I_o = 5mA$ , $T_j = 0$ to $125^\circ C$	—	-1	—	mV/ $^\circ C$	

Note: The specified condition  $T_j = 25^\circ C$  means that the test should be carried out with the test time so short (within 10mS), that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

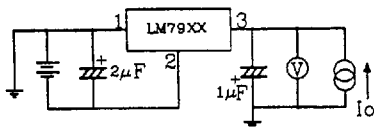
## LM7924 ELECTRICAL CHARACTERISTICS

( $V_{in} = -33V$ ,  $I_{out} = 500mA$ ,  $C_{in} = 2\mu F$ ,  $C_{out} = 1\mu F$ ,  $T_j = 0^\circ C$  to  $125^\circ C$ , unless otherwise specified.)

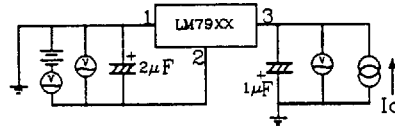
Item	Symbol	Test Circuit	Condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	1	$T_j = 25^\circ C$	-23.52	-24	-24.48	V	
Output Voltage Tolerance	$V_o$	1	$V_i = -27$ to $-38V$ , $I_o = 5mA$ to $1A$ , $P_D < 1.5W$	-23.42	-	-24.58	V	
Line Regulation	REGline	1	$T_j = 25^\circ C$	$V_i = -27$ to $-38V$	-	18	480	mV
				$V_i = -30$ to $-36V$	-	6	240	mV
Load Regulation	REGload	1	$T_j = 25^\circ C$	$I_o = 5mA$ to $1.5A$	-	12	480	mV
				$I_o = 250mA$ to $750mA$	-	4	240	mV
Bias Current	$I_{IB}$	2	$T_j = 25^\circ C$	-	3	5	mA	
Input Bias Current Fluctuation	$\Delta I_{IB}$ Input	2	$V_i = -27$ to $-38V$ , $T_j = 25^\circ C$	-	-	1	mA	
Load Bias Current Fluctuation	$\Delta I_{IB}$ Load	2	$I_o = 5mA$ to $1A$ , $T_j = 25^\circ C$	-	-	0.5	mA	
Output Noise Voltage	$V_n$	1	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$	-	170	-	$\mu V$	
Ripple Rejection Ratio	RR	3	$V_i = -28$ to $-38V$ , $I_o = 100mA$ , $f = 120Hz$	50	65	-	dB	
Min. I/O Voltage Difference	$V_{dif}$		$I_o = 1A$ , $T_j = 25^\circ C$	-	1.1	-	V	
Peak Output Current	$I_o$ -peak	1	$T_j = 25^\circ C$	-	2.1	-	A	
Output Voltage Temperature Coefficient	$\Delta V_o/T_a$	1	$I_o = 5mA$ , $T_j = 0$ to $125^\circ C$	-	-1	-	mV/ $^\circ C$	

Note: The specified condition  $T_j = 25^\circ C$  means that the test should be carried out with the test time so short (within 10mS), that the drift in characteristic value due to the rise in chip junction temperature can be ignored.

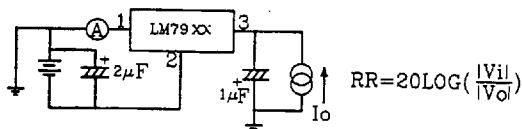
TEST CIRCUIT 1



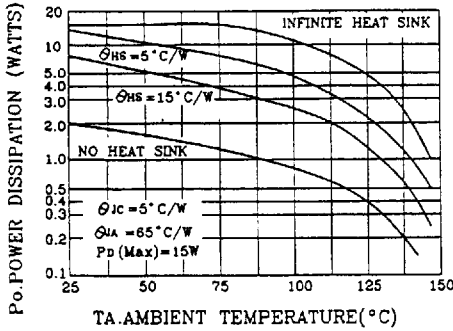
TEST CIRCUIT 2



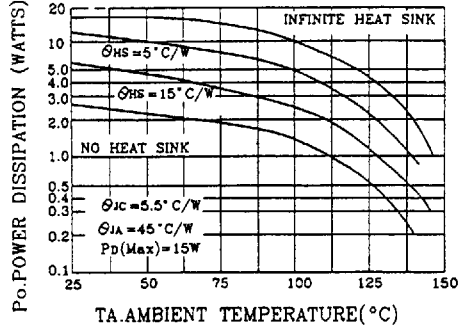
TEST CIRCUIT 3



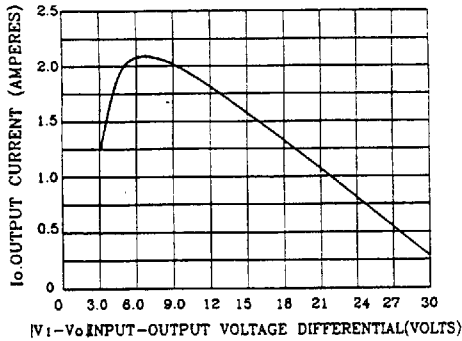
**FIGURE 1-WORSE CASE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE**



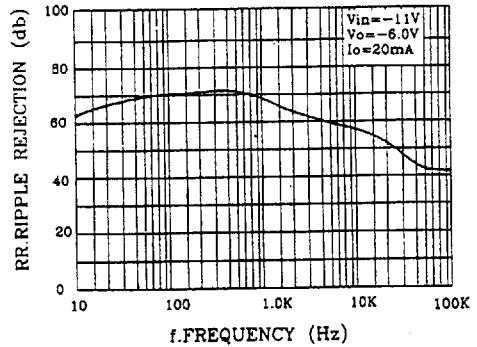
**FIGURE 2-WORSE CASE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE**



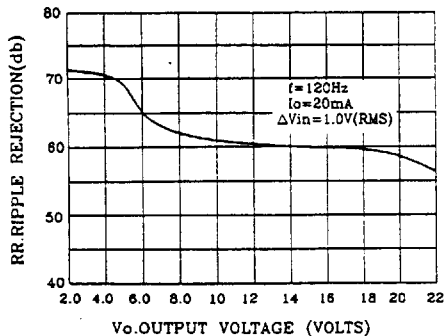
**FIGURE 3-PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE**



**FIGURE 4-RIPPLE REJECTION AS A FUNCTION OF FREQUENCY**



**FIGURE 5-RIPPLE REJECTION AS A FUNCTION OF OUTPUT VOLTAGES**



**FIGURE 6-OUTPUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE**

