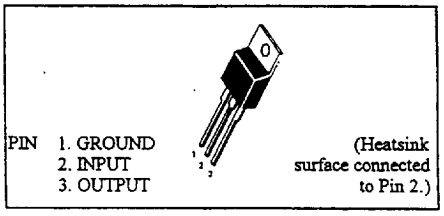
LM7900 Series 3-Terminal Negative Output Voltage Regulators

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

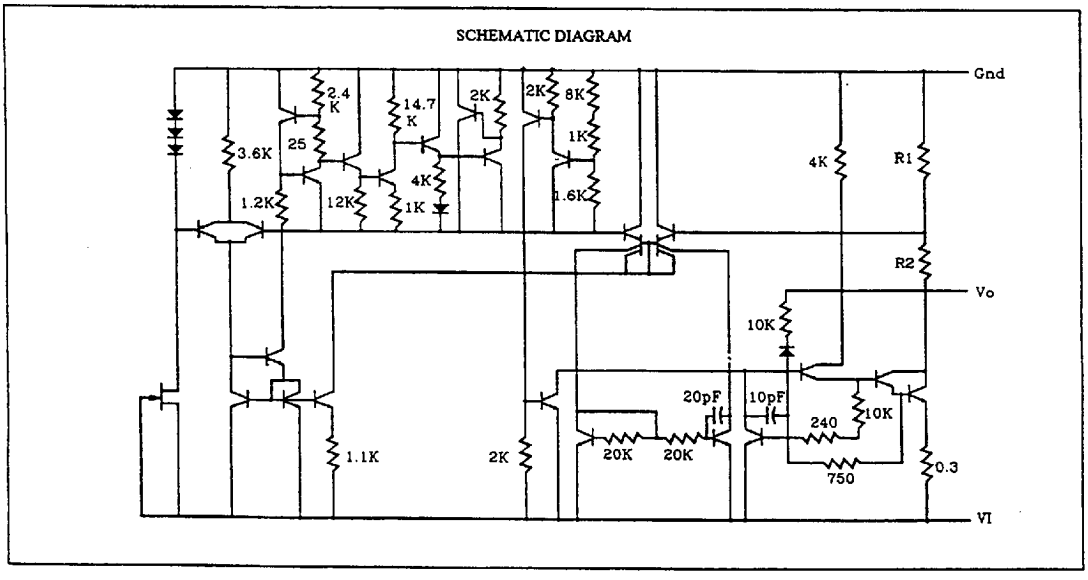


THREE-TERMINAL NEGATIVE VOLTAGE REGULATORS

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 1.5ampere.

CIRCUIT SCHEMATIC



ABSOLUTE MAXIMUM RATINGS (Ta=25℃)

Item	Symbol	LM7900 Series	Unit
Input Voltage	Vin *1	-30	V
Input Voltage	Vin *2	-40	V
Power Dissipation	P_D*3	15	W
Operating Ambient Temperature	Topr	-20 to +75	℃
Operating Junction Temperature	Tj	-20 to +125	℃
Storage Temperature	Tstg	-55 to +125	℃

Note: *1: LM7905, LM7906, LM7908, LM7909, LM7912, LM7915, LM7918
*2: LM7924
*3: Follow the derating curve. When Tj exceeds 150℃, the internal circuit cuts off the output.

LM7905 ELECTRICAL CHARACTERISTICS

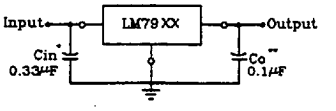
(Vin=-10V, Iout=500mA, Cin=2μF, Cout=1μF; Tj=0℃ to 125℃, unless otherwise specified.)

Item	Symbol	Test Circuit	Condition		Min.	Typ.	Max.	Unit
Output Voltage	Vo	1	Tj=25℃		-4.9	-5.0	-5.1	V
Output Voltage Tolerance	Vo	1	Vi=-7 to -20V, I_O=5mA to 1A, P_D<15W		-4.85	–	-5.15	V
Line Regulation	REGline	1	Tj=25℃	Vi=-7 to -25V	–	3	100	mV
				Vi=-8 to -12V	–	1	50	mV
Load Regulation	REGload	1	Tj=25℃	I_O=5mA to 1.5A	–	10	100	mV
				I_O=250mA to 750mA	–	3	50	mV
Bias Current	I_{IB}	2	Tj=25℃		–	2	4	mA
Input Bias Current Fluctuation	ΔI_{IB} Input	2	Vi=-7 to -25V, Tj=25℃		–	–	1.3	mA
Load Bias Current Fluctuation	ΔI_{IB} Load	2	I_O=5mA to 1A, Tj=25℃		–	–	0.5	mA
Output Noise Voltage	Vn	1	f=10Hz to 100KHz, Ta=25℃		–	40	–	μV
Ripple Rejection Ratio	RR	3	Vi=-8 to -18V, I_O=100mA, f=120Hz		62	74	–	dB
Min. I/O Voltage Difference	Vdif		I_O=1A, Tj=25℃		–	1.1	–	V
Peak Output Current	Io-peak	1	Tj=25℃		–	2.1	–	A
Output Voltage Tempoerature Coefficient	ΔVo/Ta	1	I_O=5mA, Tj=0 to 125℃		–	-0.4	–	mV/℃

Note: The specified condition Tj=25℃ 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.
* =Cin is required if regulator is located an appreciable distance from power supply filter.
** =Co improves stability and transient response.

LM7906 ELECTRICAL CHARACTERISTICS

(Vin=-11V, Iout=500mA, Cin=2μF, Cout=1μF; Tj=0℃ to 125℃, unless otherwise specified.)

Item	Symbol	Test Circuit	Condition		Min.	Typ.	Max.	Unit
Output Voltage	Vo	1	Tj=25℃		-5.88	-6	-6.12	V
Output Voltage Tolerance	Vo	1	Vi=-8 to -21V, I_O=5mA to 1A, P_D<15W		-5.83	--	-6.17	V
Line Regulation	REGline	1	Tj=25℃	Vi=-8 to -25V	--	4	120	mV
				Vi=-9 to -13V	--	1.5	60	mV
Load Regulation	REGload	1	Tj=25℃	I_O=5mA to 1.5A	--	10	120	mV
				I_O=250mA to 750mA	--	3	60	mV
Bias Current	I_{IB}	2	Tj=25℃		--	2	4	mA
Input Bias Current Fluctuation	Δ I_{IB} Input	2	Vi=-8 to -25V, Tj=25℃		--	--	1.3	mA
Load Bias Current Fluctuation	Δ I_{IB} Load	2	I_O=5mA to 1A, Tj=25℃		--	--	0.5	mA
Output Noise Voltage	Vn	1	f=10Hz to 100KHz, Ta=25℃		--	44	--	μV
Ripple Rejection Ratio	RR	3	Vi=-9 to -19V, I_O=100mA, f=120Hz		60	73	--	dB
Min. I/O Voltage Difference	Vdif		I_O=1A, Tj=25℃		--	1.1	--	V
Peak Output Current	Io-peak	1	Tj=25℃		--	2.1	--	A
Output Voltage Tempoerature Coefficient	Δ Vo/Ta	1	I_O=5mA, Tj=0 to 125℃		--	-0.5	--	mV/℃

Note: The specified condition Tj=25℃ 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

(Vin=-14V, Iout=500mA, Cin=2μF, Cout=1μF; Tj=0℃ to 125℃, unless otherwise specified.)

Item	Symbol	Test Circuit	Condition		Min.	Typ.	Max.	Unit
Output Voltage	Vo	1	Tj=25℃		-7.84	-8	-8.16	V
Output Voltage Tolerance	Vo	1	Vi=-10.5 to -23V, Io=5mA to 1A, P_D<15W		-7.74	--	-8.26	V
Line Regulation	REGline	1	Tj=25℃	Vi=-10.5 to -25V	--	6	160	mV
				Vi=-11 to -17V	--	2	80	mV
Load Regulation	REGload	1	Tj=25℃	I_O=5mA to 1.5A	--	12	160	mV
				I_O=250mA to 750mA	--	4	80	mV
Bias Current	I_{IB}	2	Tj=25℃		--	2.2	4.5	mA
Input Bias Current Fluctuation	Δ I_{IB} Input	2	Vi=-10.5 to -25V, Tj=25℃		--	--	1	mA
Load Bias Current Fluctuation	Δ I_{IB} Load	2	I_O=5mA to 1A, Tj=25℃		--	--	0.5	mA
Output Noise Voltage	Vn	1	f=10Hz to 100KHz, Ta=25℃		--	52	--	μV
Ripple Rejection Ratio	RR	3	Vi=-11 to -21V, I_O=100mA, f=120Hz		56	71	--	dB
Min. I/O Voltage Difference	Vdif		I_O=1A, Tj=25℃		--	2	--	V
Peak Output Current	Io-peak	1	Tj=25℃		--	2.1	--	A
Output Voltage Tempoerature Coefficient	Δ Vo/Ta	1	I_O=5mA, Tj=0 to 125℃		--	-0.6	--	mV/℃

Note: The specified condition Tj=25℃ 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

(Vin=-15V, Iout=500mA, Cin=2μ F, Cout=1μ F; Tj=0℃ to 125℃, unless otherwise specified.)

Item	Symbol	Test Circuit	Condition		Min.	Typ.	Max.	Unit
Output Voltage	Vo	1	Tj=25℃		-8.82	-9	-9.18	V
Output Voltage Tolerance	Vo	1	Vi=-11.5 to -24V, I_O=5mA to 1A, P_D<15W		-8.72	–	-9.28	V
Line Regulation	REGline	1	Tj=25℃	Vi=-11.5 to -26V	–	7	180	mV
				Vi=-12 to -18V	–	2	90	mV
Load Regulation	REGload	1	Tj=25℃	I_O=5mA to 1.5A	–	12	180	mV
				I_O=250mA to 750mA	–	4	90	mV
Bias Current	I_{IB}	2	Tj=25℃		–	2.2	4.5	mA
Input Bias Current Fluctuation	ΔI_{IB} Input	2	Vi=-11.5 to -26V, Tj=25℃		–	–	1	mA
Load Bias Current Fluctuation	ΔI_{IB} Load	2	I_O=5mA to 1A, Tj=25℃		–	–	0.5	mA
Output Noise Voltage	Vn	1	f=10Hz to 100KHz, Ta=25℃		–	58	–	μ V
Ripple Rejection Ratio	RR	3	Vi=-12 to -22V, I_O=100mA, f=120Hz		56	71	–	dB
Min. I/O Voltage Difference	Vdif		I_O=1A, Tj=25℃		–	1.1	–	V
Peak Output Current	Io-peak	1	Tj=25℃		–	2.1	–	A
Output Voltage Tempoerature Coefficient	Δ Vo/Ta	1	I_O=5mA, Tj=0 to 125℃		–	-0.6	–	mV/℃

Note: The specified condition Tj=25℃ 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

(Vin=-19V, Iout=500mA, Cin=2μ F, Cout=1μ F; Tj=0℃ to 125℃, unless otherwise specified.)

Item	Symbol	Test Circuit	Condition		Min.	Typ.	Max.	Unit
Output Voltage	Vo	1	Tj=25℃		-11.76	-12	-12.24	V
Output Voltage Tolerance	Vo	1	Vi=-14.5 to -27V, Io=5mA to 1A, P_D<15W		-11.66	–	-12.34	V
Line Regulation	REGline	1	Tj=25℃	Vi=-14.5 to -30V	–	10	240	mV
				Vi=-16 to -22V	–	3	120	mV
Load Regulation	REGload	1	Tj=25℃	I_O=5mA to 1.5A	–	12	240	mV
				I_O=250mA to 750mA	–	4	120	mV
Bias Current	I_{IB}	2	Tj=25℃		–	2.5	5	mA
Input Bias Current Fluctuation	ΔI_{IB} Input	2	Vi=-14.5 to -30V, Tj=25℃		–	–	1	mA
Load Bias Current Fluctuation	ΔI_{IB} Load	2	I_O=5mA to 1A, Tj=25℃		–	–	0.5	mA
Output Noise Voltage	Vn	1	f=10Hz to 100KHz, Ta=25℃		–	75	–	μ V
Ripple Rejection Ratio	RR	3	Vi=-15 to -25V, I_O=100mA, f=120Hz		55	70	–	dB
Min. I/O Voltage Difference	Vdif		I_O=1A, Tj=25℃		–	1.1	–	V
Peak Output Current	Io-peak	1	Tj=25℃		–	2.1	–	A
Output Voltage Tempoerature Coefficient	Δ Vo/Ta	1	I_O=5mA, Tj=0 to 125℃		–	-0.8	–	mV/℃

Note: The specified condition Tj=25℃ 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

(Vin=-23V, Iout=500mA, Cin=2μ F, Cout=1μ F; Tj=0℃ to 125℃, unless otherwise specified.)

Item	Symbol	Test Circuit	Condition		Min.	Typ.	Max.	Unit
Output Voltage	Vo	1	Tj=25℃		-14.7	-15	-15.3	V
Output Voltage Tolerance	Vo	1	Vi=-17.5 to -30V, I_O=5mA to 1A, P_D<15W		-14.55	–	-15.45	V
Line Regulation	REGline	1	Tj=25℃	Vi=-17.5 to -30V	–	11	300	mV
				Vi=-20 to -26V	–	3	150	mV
Load Regulation	REGload	1	Tj=25℃	I_O=5mA to 1.5A	–	12	300	mV
				I_O=250mA to 750mA	–	4	150	mV
Bias Current	I_{IB}	2	Tj=25℃		–	2.5	5	mA
Input Bias Current Fluctuation	Δ I_{IB} Input	2	Vi=-17.5 to -30V, Tj=25℃		–	–	1	mA
Load Bias Current Fluctuation	Δ I_{IB} Load	2	I_O=5mA to 1A, Tj=25℃		–	–	0.5	mA
Output Noise Voltage	Vn	1	f=10Hz to 100KHz, Ta=25℃		–	90	–	μ V
Ripple Rejection Ratio	RR	3	Vi=-18.5 to -28.5V, I_O=100mA, f=120Hz		54	69	–	dB
Min. I/O Voltage Difference	Vdif		I_O=1A, Tj=25℃		–	1.1	–	V
Peak Output Current	Io-peak	1	Tj=25℃		–	2.1	–	A
Output Voltage Tempoerature Coefficient	Δ Vo/Ta	1	I_O=5mA, Tj=0 to 125℃		–	-0.9	–	mV/℃

Note: The specified condition Tj=25℃ 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

(Vin=-27V, Iout=500mA, Cin=2μ F, Cout=1μ F; Tj=0℃ to 125℃, unless otherwise specified.)

Item	Symbol	Test Circuit	Condition		Min.	Typ.	Max.	Unit
Output Voltage	Vo	1	Tj=25℃		-17.64	-18	-18.36	V
Output Voltage Tolerance	Vo	1	Vi=-21 to -33V, I_O=5mA to 1A, P_D<15W		-17.54	–	-18.46	V
Line Regulation	REGline	1	Tj=25℃	Vi=-21 to -33V	–	15	360	mV
				Vi=-24 to -30V	–	5	180	mV
Load Regulation	REGload	1	Tj=25℃	I_O=5mA to 1.5A	–	12	360	mV
				I_O=250mA to 750mA	–	4	180	mV
Bias Current	I_{IB}	2	Tj=25℃		–	2.5	5	mA
Input Bias Current Fluctuation	Δ I_{IB} Input	2	Vi=-21 to -33V, Tj=25℃		–	–	1	mA
Load Bias Current Fluctuation	Δ I_{IB} Load	2	I_O=5mA to 1A, Tj=25℃		–	–	0.5	mA
Output Noise Voltage	Vn	1	f=10Hz to 100KHz, Ta=25℃		–	110	–	μ V
Ripple Rejection Ratio	RR	3	Vi=-22 to -32V, I_O=100mA, f=120Hz		53	68	–	dB
Min. I/O Voltage Difference	Vdif		I_O=1A, Tj=25℃		–	1.1	–	V
Peak Output Current	Io-peak	1	Tj=25℃		–	2.1	–	A
Output Voltage Tempoerature Coefficient	Δ Vo/Ta	1	I_O=5mA, Tj=0 to 125℃		–	-1	–	mV/℃

Note: The specified condition Tj=25℃ 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.

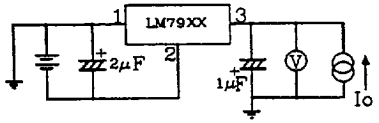
LM7924 ELECTRICAL CHARACTERISTICS

(Vin=-33V, Iout=500mA, Cin=2μF, Cout=1μF; Tj=0℃ to 125℃, unless otherwise specified.)

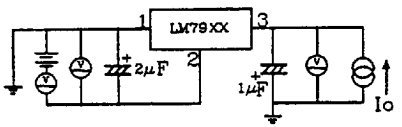
Item	Symbol	Test Circuit	Condition		Min.	Typ.	Max.	Unit
Output Voltage	Vo	1	Tj=25℃		-23.52	-24	-24.48	V
Output Voltage Tolerance	Vo	1	Vi=-27 to -38V, I_O=5mA to 1A, P_D<15W		-23.42	–	-24.58	V
Line Regulation	REGline	1	Tj=25℃	Vi=-27 to -38V	–	18	480	mV
				Vi=-30 to -36V	–	6	240	mV
Load Regulation	REGload	1	Tj=25℃	I_O=5mA to 1.5A	–	12	480	mV
				I_O=250mA to 750mA	–	4	240	mV
Bias Current	I_{IB}	2	Tj=25℃		–	3	5	mA
Input Bias Current Fluctuation	ΔI_{IB} Input	2	Vi=-27 to -38V, Tj=25℃		–	–	1	mA
Load Bias Current Fluctuation	ΔI_{IB} Load	2	I_O=5mA to 1A, Tj=25℃		–	–	0.5	mA
Output Noise Voltage	Vn	1	f=10Hz to 100KHz, Ta=25℃		–	170	–	μV
Ripple Rejection Ratio	RR	3	Vi=-28 to -38V, I_O=100mA, f=120Hz		50	65	–	dB
Min. I/O Voltage Difference	Vdif		I_O=1A, Tj=25℃		–	1.1	–	V
Peak Output Current	Io-peak	1	Tj=25℃		–	2.1	–	A
Output Voltage Tempoerature Coefficient	Δ Vo/Ta	1	I_O=5mA, Tj=0 to 125℃		–	-1	–	mV/℃

Note: The specified condition Tj=25℃ 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.

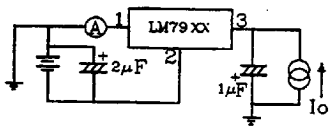
TEST CIRCUIT 1



TEST CIRCUIT 2



TEST CIRCUIT 3



$RR=20LOG(\frac{|Vil|}{|Vol|})$

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

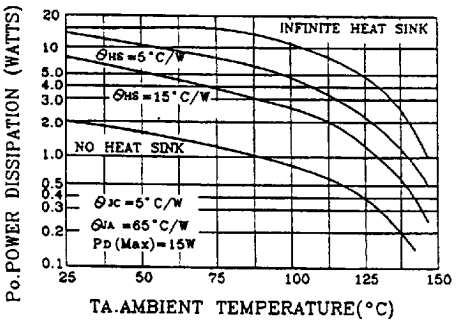


FIGURE 2-WORSE CASE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE

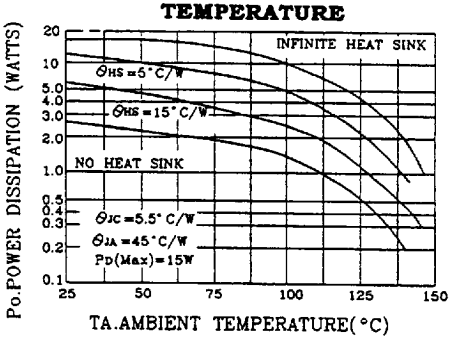


FIGURE 3-PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE

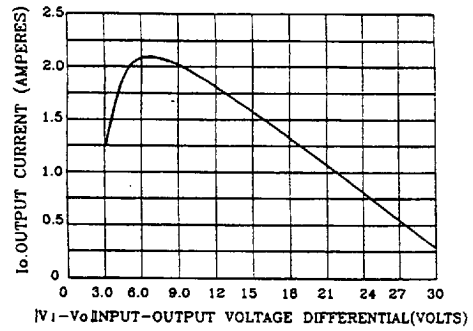


FIGURE 4-RIPPLE REJECTION AS A FUNCTION OF FREQUENCY

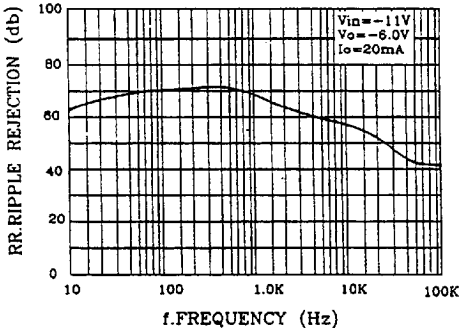


FIGURE 5-RIPPLE REJECTION AS A FUNCTION OF OUTPUT VOLTAGES

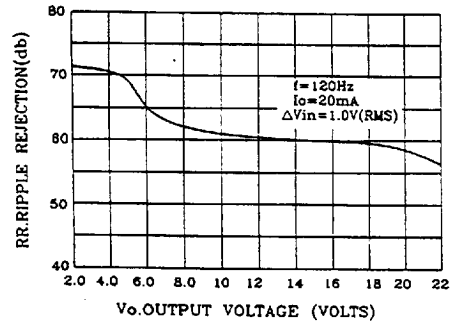


FIGURE 6-OUTPUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE