LM7800 Series 3-Terminal Fixed Voltage Regulators

THREE-TERMINAL POSITIVE VOLTAGE REGULATORS

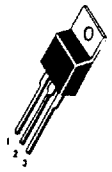
These voltage regulators are monolithic integrated circuits designed as fixed-voltage regulators for a wide variety of applications including local, on-card regulation. These regulators employ internal current limiting, thermal shutdown, and safe-area compensation. With adequate heatsinking they can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

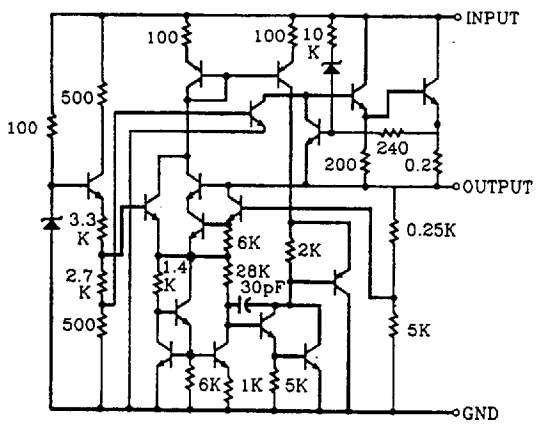


PIN 1. INPUT
2. GROUND
3. OUTPUT

(Heatsink surface connected to Pin 2.)

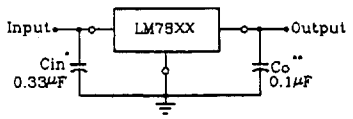
CIRCUIT SCHEMATIC

REPRESENTATIVE SCHEMATIC DIAGRAM



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 an appreciable

• ABSOLUTE MAXIMUM RATINGS (Ta=25℃)

Item	Symbol	LM7800 Series	Unit
Input Voltage	Vin *	30	V
Input Voltage	Vin **	40	V
Power Dissipation	P_D***	15	W
Operating Ambient Temperature	Topr	-20 to +75	℃
Operating Junction Temperature	Tj	-20 to +125	℃
Storage Temperature	Tstg	-55 to +125	℃

Note: *LM7805 to LM7818

** LM7824

***Follow the derating curve

• LM7805 ELECTRICAL CHARACTERISTICS

(Vin=10V, Iout=500mA, 0℃ ≤Tj≤ 125℃, Cin=0.33μ F, Cout=0.1μ F; unless otherwise specified.)

Item	Symbol	Test Conditions		min.	typ.	max.	unit
Output Voltage	Vout	Tj=25℃		4.90	5.0	5.10	V
		7V≤Vin≤20V, 5mA≤Iout≤1.0A, P_D≤15W		4.85	--	5.15	V
Line Regulation	REGline	Tj=25℃	7V≤Vin≤25V	--	3	100	mV
			8V≤Vin≤12V	--	1	50	mV
Load Regulation	REGload	Tj=25℃	5mA≤Iout≤1.5A	--	15	100	mV
			250mA≤Iout≤750mA	--	5	50	mV
Quiescent Current	Iq	Tj=25℃, 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℃, 10Hz≤f≤100KHz		--	40	--	μ V
Ripple Rejection Ratio	RR	f=120Hz		62	78	--	dB
Voltage Drop	Vdrop	Iout=1.0A, Tj=25℃		--	2.0	--	V
Output Resistance	Rout	f=1KHz		--	17	--	mΩ
Output Short Circuit Current	Ios	Tj=25℃		--	750	--	mA
Peak Output Current	Io peak	Tj=25℃		--	2.2	--	A
Temperature Coefficient of Output Voltage	Δ Vout/ Δ Tj	Iout=5mA, 0℃ ≤Tj≤125℃		--	-1.1	--	mV/℃

• LM7806 ELECTRICAL CHARACTERISTICS

(Vin=11V, Iout=500mA, 0℃ ≤Tj≤ 125℃, Cin=0.33μ F, Cout=0.1μ F; unless otherwise specified.)

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

• LM7808 ELECTRICAL CHARACTERISTICS

(Vin=14V, Iout=500mA, 0℃ ≤Tj≤ 125℃, Cin=0.33μ F, Cout=0.1μ F; unless otherwise specified.)

Item	Symbol	Test Conditions		min.	typ.	max.	unit
Output Voltage	Vout	Tj=25℃		7.84	8.0	8.16	V
		10.5V≤Vin≤23V, 5mA≤Iout≤1.0A, P_D≤15W		7.74	--	8.26	V
Line Regulation	Δ REGline	Tj=25℃	10.5V≤Vin≤25V	--	6	160	mV
			11V≤Vin≤17V	--	2.0	80	mV
Load Regulation	Δ REGload	Tj=25℃	5mA≤Iout≤1.5A	--	12	160	mV
			250mA≤Iout≤750mA	--	4	80	mV
Quiescent Current	Iq	Tj=25℃, Iout=0		--	4.3	8.0	mA
Quiescent Current Change	Δ Iq	10.5V≤Vin≤25V		--	--	1.0	mA
		5mA≤Iout≤1.0A		--	--	0.5	mA
Output Noise Voltage	Vn	Ta=25℃, 10Hz≤f≤100KHz		--	52	--	μ V
Ripple Rejection Ratio	RR	f=120Hz		56	72	--	dB
Voltage Drop	Vdrop	Iout=1.0A, Tj=25℃		--	2.0	--	V
Output Resistance	Rout	f=1KHz		--	16	--	mΩ

• LM7809 ELECTRICAL CHARACTERISTICS

(Vin=15V, Iout=500mA, 0℃ ≤Tj≤ 125℃, Cin=0.33μ F, Cout=0.1μ F; unless otherwise specified.)

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

• LM7810 ELECTRICAL CHARACTERISTICS

(Vin=16V, Iout=500mA, 0℃ ≤Tj≤ 125℃, Cin=0.33μ F, Cout=0.1μ F; unless otherwise specified.)

Item	Symbol	Test Conditions		min.	typ.	max.	unit
Output Voltage	Vout	Tj=25℃		9.8	10	10.2	V
		17.5V≤Vin≤30V, 5mA≤Iout≤1.0A, P_D≤15W		9.75	-	12.25	V
Line Regulation	Δ REGline	Tj=25℃	10.5V≤Vin≤30V	--	10	240	mV
			13V≤Vin≤9V	--	3.0	120	mV
Load Regulation	Δ REGload	Tj=25℃	5mA≤Iout≤1.5A	--	12	240	mV
			250mA≤Iout≤750mA	--	4.0	120	mV
Quiescent Current	Iq	Tj=25℃, Iout=0		--	4.3	8.0	mA
Quiescent Current Change	Δ Iq	14.5V≤Vin≤30V		--	--	1.0	mA
		5mA≤Iout≤1.0A		--	--	0.5	mA
Output Noise Voltage	Vn	Ta=25℃, 10Hz≤f≤100KHz		--	52	--	μ V
Ripple Rejection Ratio	RR	f=120Hz		54	72	--	dB
Voltage Drop	Vdrop	Iout=1.0A, Tj=25℃		--	2.0	--	V
Output Resistance	Rout	f=1KHz		--	16	--	mΩ

• LM7812 ELECTRICAL CHARACTERISTICS

(Vin=19V, Iout=500mA, 0℃ ≤ Tj ≤ 125℃, Cin=0.33μ F, Cout=0.1μ F; unless otherwise specified.)

Item	Symbol	Test Conditions		min.	typ.	max.	unit
Output Voltage	Vout	Tj=25℃		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℃	14.5V≤Vin≤30V	--	10	240	mV
			16V≤Vin≤22V	--	3.0	120	mV
Load Regulation	Δ REGload	Tj=25℃	5mA≤Iout≤1.5A	--	12	240	mV
			250mA≤Iout≤750mA	--	4.0	120	mV
Quiescent Current	Iq	Tj=25℃, Iout=0		--	4.3	8.0	mA
Quiescent Current Change	Δ Iq	14.5V≤Vin≤30V		--	--	1.0	mA
		5mA≤Iout≤1.0A		--	--	0.5	mA
Output Noise Voltage	Vn	Ta=25℃, 10Hz≤f≤100KHz		--	75	--	μ V
Ripple Rejection Ratio	RR	f=120Hz		55	71	--	dB
Voltage Drop	Vdrop	Iout=1.0A, Tj=25℃		--	2.0	--	V
Output Resistance	Rout	f=1KHz		--	18	--	mΩ
Output Short Circuit Current	Ios	Tj=25℃		--	350	--	mA
Peak Output Current	Io peak	Tj=25℃		--	2.2	--	A
Temperature Coefficient of Output Voltage	Δ Vout/Δ Tj	Iout=5mA, 0℃ ≤Tj≤125℃		--	-1.0	--	mV/℃

• LM7815 ELECTRICAL CHARACTERISTICS

(Vin=23V, Iout=500mA, 0℃ ≤ Tj ≤ 125℃, Cin=0.33μ F, Cout=0.1μ F; unless otherwise specified.)

Item	Symbol	Test Conditions		min.	typ.	max.	unit
Output Voltage	Vout	Tj=25℃		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℃	17.5V≤Vin≤30V	--	11	300	mV
			20V≤Vin≤26V	--	3.0	150	mV
Load Regulation	Δ REGload	Tj=25℃	5mA≤Iout≤1.5A	--	12	300	mV
			250mA≤Iout≤750mA	--	4	150	mV
Quiescent Current	Iq	Tj=25℃, Iout=0		--	4.4	8.0	mA
Quiescent Current Change	Δ Iq	17.5V≤Vin≤30V		--	--	1.0	mA
		5mA≤Iout≤1.0A		--	--	0.5	mA
Output Noise Voltage	Vn	Ta=25℃, 10Hz≤f≤100KHz		--	90	--	μ V
Ripple Rejection Ratio	RR	f=120Hz		54	70	--	dB
Voltage Drop	Vdrop	Iout=1.0A, Tj=25℃		--	2.0	--	V
Output Resistance	Rout	f=1KHz		--	19	--	mΩ

• LM7818 ELECTRICAL CHARACTERISTICS

(Vin=27V, Iout=500mA, 0℃ ≤Tj≤ 125℃, Cin=0.33μ F, Cout=0.1μ F; unless otherwise specified.)

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

• LM7824 ELECTRICAL CHARACTERISTICS

(Vin=33V, Iout=500mA, 0℃ ≤Tj≤ 125℃, Cin=0.33μ F, Cout=0.1μ F; unless otherwise specified.)

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

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

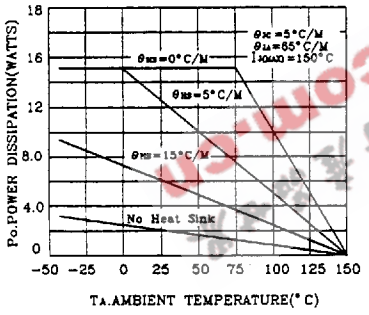


FIGURE 2 - WORST CASE POWER DISSIPATION versus AMBIENT TEMPERATURE (Case 1)

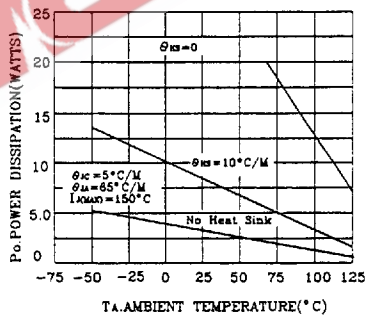


FIGURE 3 - INPUT OUTPUT DIFFERENTIAL AS A FUNCTION OF JUNCTION TEMPERATURE

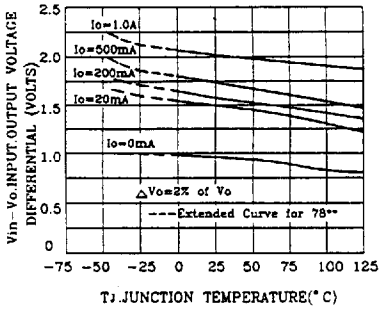


FIGURE 4 - INPUT OUTPUT DIFFERENTIAL AS A FUNCTION OF JUNCTION TEMPERATURE

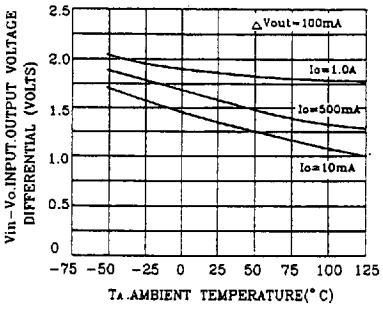


FIGURE 5 - PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE

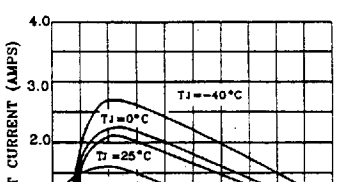


FIGURE 6 -PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE

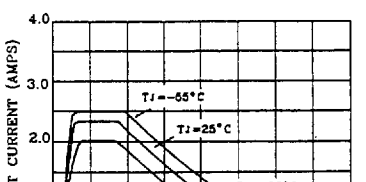


FIGURE 7 - RIPPLE REJECTION AS A FUNCTION OF OUTPUT VOLTAGE

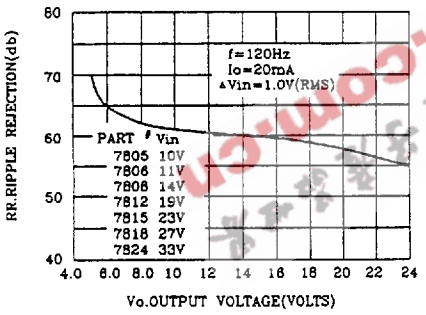


FIGURE 8 - RIPPLE REJECTION AS A FUNCTION OF FREQUENCY

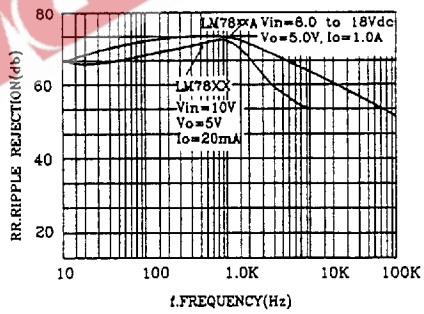


FIGURE 9 - OUTPUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

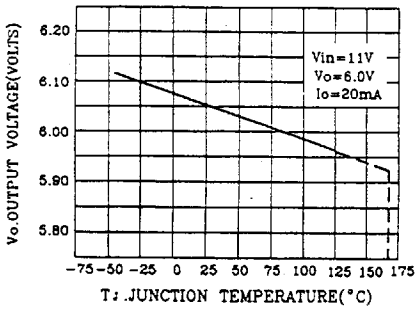


FIGURE 10 - OUTPUT IMPEDANCE AS A FUNCTION OF OUTPUT VOLTAGE

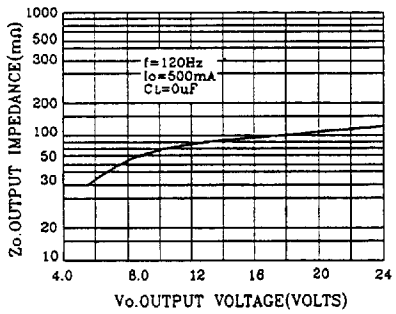


FIGURE 11 - QUIESCENT CURRENT AS A FUNCTION OF TEMPERATURE

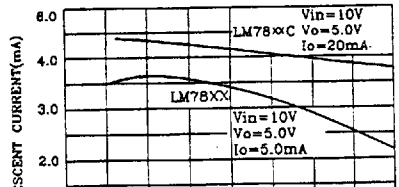


FIGURE 12 -DROPOUT CHARACTERISTICS