1.5 AMP, 3-TERMINAL NEGATIVE REGULATORS

IP120A, IP120, LM120, IP7900A Series, IP7900 Series

DESCRIPTION

The IP120A/IP7900A/IP7900 series of three-terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. The A-suffix devices provide 0.01%/V line regulation, 0.3%/A load regulation, and ±1% output voltage tolerance at room temperature. Protection features include safe operating area current limiting and thermal shutdown. The entire series of regulators is available in the metal TO-3 and TO-66 power packages. The IP120A/LM120/IP7900A/IP7900 series is now available in a new TO-257 (hermetic TO-220 style) power package.

FEATURES

- 1% Tolerance
- −5, −12 and −15V fixed output voltages available
- 0.01%/V line regulation
- 0.3%/A load regulation
- Thermal overload protection
- Short-circuit current limit protection
- Safe area protection
- Start-up with positive voltage (± supplies) on output

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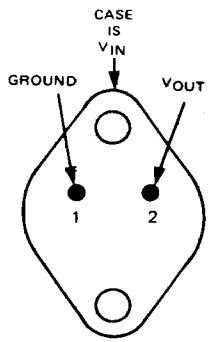
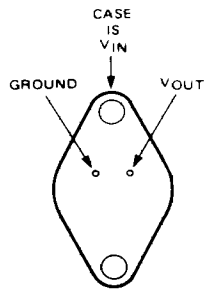
CONNECTIONS

(Bottom View)



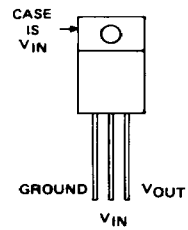
TO-3

(Bottom View)



TO-66

(Top View)



TO-257

1.5 AMP, 3-TERMINAL NEGATIVE REGULATORS

ABSOLUTE MAXIMUM RATINGS

Input Voltage (V_O = −5V, −12V, −15V) 35V

Internal Power Dissipation (Note 1) Internally Limited

Operating Temperature Range (T_j)
IP120A, IP120, LM120 −55°C to +150°C
IP7900A, IP7900 −55°C to +150°C

Maximum Junction Temperature
TO-3 Package K 150°C
TO-66 Package R 150°C
TO-257 (Hermetic TO-220 style) G 150°C

Storage Temperature Range −65°C to +150°C

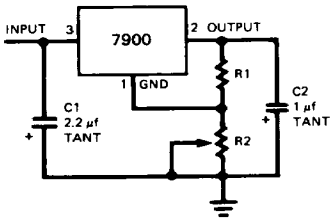
Lead Temperature (Soldering, 10 sec.) +300°C

Absolute maximum ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The electrical characteristics provide conditions for actual device operation.

Note 1. Although power dissipation is internally limited, these specifications are applicable for maximum power dissipation P_{MAX} of 20W for the TO-3, TO-66 and TO-257. I_{MAX} is 1.0A for the TO-3, TO-66 and TO-257 package.

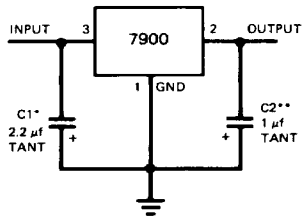
APPLICATION INFORMATION

Adjustable Output Regulator



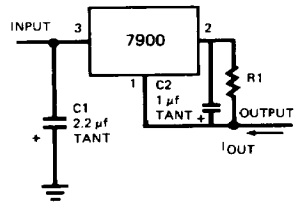
$$V_{out} \approx V_{reg} \frac{(R_1 + R_2)}{R_1}$$

Fixed Output Regulator



*Required if the regulator is located far from the power supply filter.
**Required for stability. 25 µf electrolytic may be substituted.

Current Regulator



$$I_{out} = \frac{V_{reg}}{R1} + I_Q$$

ORDER INFORMATION

Part Number	Temperature Range	Package
IP120AK-XX/IP120K-XX/LM120K-XX	−55°C to +150°C	TO-3
IP7900AK/IP7900K	−55°C to +150°C	TO-3
IP120AR-XX/IP120R-XX	−55°C to +150°C	TO-66
IP7900AR/IP7900R	−55°C to +150°C	TO-66
IP120AG-XX/IP120G-XX	−55°C to +150°C	TO-257 (Hermetic TO-220 style)
IP7900AG/IP7900G	−55°C to +150°C	TO-257 (Hermetic TO-220 style)

1.5 AMP, 3-TERMINAL NEGATIVE REGULATORS

ELECTRICAL CHARACTERISTICS (NOTE 2)

Parameter	Test Conditions			IP7905A IP120A-5 Min	IP7905A IP120A-5 Typ	IP7905A IP120A-5 Max	IP7905 IP120-5 LM120-5 Min	IP7905 IP120-5 LM120-5 Typ	IP7905 IP120-5 LM120-5 Max	Units
Output Voltage, V_O	I_O = 500 mA, V_{IN} = -10V			-4.95	-5	-5.05	-4.9	-5	-5.1	V
	$P_D \leq P_{MAX}$, 5mA $\leq I_O \leq I_{MAX}$ -7.5V $\leq V_{IN} \leq$ -20V		•	-4.85		-5.15	-4.8		-5.2	V
Low Supply, V_O	$P_D \leq P_{MAX}$, 5mA $\leq I_O \leq I_{MAX}$ -7V $\leq V_{IN} \leq$ -20V			-4.75		-5.15	-4.75		-5.25	V
Line Regulation, $\triangle V_O$	I_O = 0.5 I_{MAX}	-7V $\leq V_{IN} \leq$ -25V			3	10		3	25	mV
		-7.5V $\leq V_{IN} \leq$ -20V	•		3	10		3	50	mV
	$I_O \leq I_{MAX}$	-8V $\leq V_{IN} \leq$ -12V			1	4		1	25	mV
			•		1	12		2	50	mV
Load Regulation, $\triangle V_O$	V_{IN} = -10V	5 mA $\leq I_O \leq$ 1.5A			10	25		10	75	mV
		250mA $\leq I_O \leq$ 750mA			4	15		4	25	mV
	5 mA $\leq I_O \leq I_{MAX}$, V_{IN} = -10V		•		7	25		7	50	mV
Quiescent Current, I_Q	$I_O \leq$ 0.5 I_{MAX}				1	1.9		1	1.9	mA
	V_{IN} = -10V		•		1	2		1	2	mA
Quiescent Current Change, $\triangle I_Q$	5 mA $\leq I_O \leq I_{MAX}$				0.2	0.4		0.2	0.4	mA
	V_{IN} = -10V		•		0.2	0.5		0.2	0.5	mA
	$I_O \leq$ 0.5 I_{MAX}, -7V $\leq V_{IN} \leq$ -25V				0.1	0.4		0.1	0.4	mA
	$I_O \leq$ 0.5 I_{MAX}, -8V $\leq V_{IN} \leq$ -25V		•		0.1	0.5		0.1	1.0	mA
Output Noise Voltage, V_N	10 Hz $\leq f \leq$ 100 kHz, V_{IN} = -10V				40	400		40	400	µV
Ripple Rejection, $\triangle V_{IN}/\triangle V_{OUT}$	f = 120 Hz	$I_O \leq I_{MAX}$		66	80		54	80		dB
	-8 V $\leq V_{IN} \leq$ -18V	$I_O \leq$ 0.5 I_{MAX}	•	66	80		54	80		dB
Dropout Voltage	$I_{OUT} = I_{MAX}$				1.1	2.3		1.1	2.3	V
Output Resistance, R_O	f = 1 kHz				5			5		mΩ
Short-Circuit Current, I_{sc}	V_{IN} = -35V				0.6	1.2		0.6	1.2	A
Peak Output Current, I_{pk}	V_{IN} = -10V				2.4	3.3		2.4	3.3	A
Average TC of V_{OUT}	I_O = 5 mA				0.2	2.0		0.2	2.0	mV/°C
Input Voltage Required to Maintain Line Regulation, V_{IN}	$I_O \leq I_{MAX}$			-7.3			-7.3			V

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1.5 AMP, 3-TERMINAL NEGATIVE REGULATORS

ELECTRICAL CHARACTERISTICS (CONT.)

Parameter	Test Conditions			IP7912A IP120A-12 Min	IP7912A IP120A-12 Typ	IP7912A IP120A-12 Max	IP7912 IP120-12 LM120-12 Min	IP7912 IP120-12 LM120-12 Typ	IP7912 IP120-12 LM120-12 Max	Units
Output Voltage, V_O	I_O = 500 mA, V_{IN} = -19V			-11.88	-12	-12.12	-11.76	-12	-12.24	V
	$P_D \leq P_{MAX}$, 5mA $\leq I_O \leq I_{MAX}$ -14.8V $\leq V_{IN} \leq$ -27V		•	-11.64		-12.36	-11.52		-12.48	V
Low Supply, V_O	$P_D \leq P_{MAX}$, 5mA $\leq I_O \leq I_{MAX}$ -14.5V $\leq V_{IN} \leq$ -27V			-11.40		-12.36	-11.4		-12.6	V
Line Regulation, $\triangle V_O$	I_O = 0.5 I_{MAX}	-14.5V $\leq V_{IN} \leq$ -30V			4	18		4	120	mV
		-14.8V $\leq V_{IN} \leq$ -27V	•		4	18		4	200	mV
	$I_O \leq I_{MAX}$	-16V $\leq V_{IN} \leq$ -22V			1	4		1	25	mV
			•		2	9		2	60	mV
Load Regulation, $\triangle V_O$	V_{IN} = −19V	5 mA $\leq I_O \leq$ 1.5A			12	32		12	80	mV
		250mA $\leq I_O \leq$ 750mA			4	19		4	60	mV
	5 mA $\leq I_O \leq I_{MAX}$, V_{IN} = -19V		•		8	60		8	120	mV
Quiescent Current, I_Q	$I_O \leq$ 0.5 I_{MAX}				0.2	0.4		0.2	0.4	mA
	V_{IN} = -19V		•		1	2		1	2.0	mA
Quiescent Current Change, $\triangle I_Q$	5 mA $\leq I_O \leq I_{MAX}$				0.2	0.4		0.2	0.4	mA
	V_{IN} = -19V		•		0.2	0.5		0.2	0.5	mA
	$I_O \leq$ 0.5 I_{MAX}, -14.5V $\leq V_{IN} \leq$ -30V				0.1	0.4		0.1	0.4	mA
	$I_O \leq$ 0.5 I_{MAX}, -15V $\leq V_{IN} \leq$ -30V		•		0.1	0.5		0.1	1.0	mA
Output Noise Voltage, V_N	10 Hz $\leq f \leq$ 100 kHz, V_{IN} = -19V				75	960		75	960	μV
Ripple Rejection, $\triangle V_{IN}/\triangle V_{OUT}$	f = 120 Hz	$I_O \leq I_{MAX}$		58	72		56	72		dB
	-15V $\leq V_{IN} \leq$ -25V	$I_O \leq$ 0.5 I_{MAX}	•	58	72		56	72		dB
Dropout Voltage	$I_{OUT} = I_{MAX}$				1.1	2.3		1.1	2.3	V
Output Resistance, R_O	f = 1 kHz				8			8		mΩ
Short-Circuit Current, I_{sc}	V_{IN} = -35V				0.6	1.2		0.6	1.2	A
Peak Output Current, I_{pk}	V_{IN} = -19V				2.4	3.3		2.4	3.3	A
Average TC of V_{OUT}	I_O = 5 mA				0.5	4.8	0.5	4.8	mV/°C	
Input Voltage Required to Maintain Line Regulation, V_{IN}	$I_O \leq I_{MAX}$			-14.5			-14.5			V

1.5 AMP, 3-TERMINAL NEGATIVE REGULATORS

ELECTRICAL CHARACTERISTICS (CONT.)

Parameter	Test Conditions			IP7915A IP120A-15 Min	IP7915A IP120A-15 Typ	IP7915A IP120A-15 Max	IP7915 IP120-15 LM120-15 Min	IP7915 IP120-15 LM120-15 Typ	IP7915 IP120-15 LM120-15 Max	Units
Output Voltage, V_O	I_O = 500 mA, V_{IN} = -23V			-14.85	-15	-15.15	-14.7	-15	-15.3	V
	$P_D \leq P_{MAX}$, 5mA $\leq I_O \leq I_{MAX}$ -17.9V $\leq V_{IN} \leq$ -30V		•	-14.55		-15.45	-14.4		-15.6	V
Low Supply, V_O	$P_D \leq P_{MAX}$, 5mA $\leq I_O \leq I_{MAX}$ -17.5V $\leq V_{IN} \leq$ -30V			-14.25		-15.45	-14.25		-15.75	V
Line Regulation, $\triangle V_O$	I_O = 0.5 I_{MAX}	-17.5V $\leq V_{IN} \leq$ -30V			4	22		4	150	mV
		-17.9V $\leq V_{IN} \leq$ -30V	•		4	22		4	250	mV
	$I_O \leq I_{MAX}$	-20V $\leq V_{IN} \leq$ -26V			2	10		2	75	mV
			•		5	30		5	150	mV
Load Regulation, $\triangle V_O$	V_{IN} = −23V	5 mA $\leq I_O \leq$ 1.5A			12	35		12	80	mV
		250mA $\leq I_O \leq$ 750mA			4	21		4	75	mV
	5 mA $\leq I_O \leq I_{MAX}$, V_{IN} = -23V		•		9	75		9	150	mV
Quiescent Current, I_Q	$I_O \leq$ 0.5 I_{MAX}				1	1.9		1	1.9	mA
	V_{IN} = -23V		•		1	2		1	2.0	mA
Quiescent Current Change, $\triangle I_Q$	5 mA $\leq I_O \leq I_{MAX}$				0.2	0.4		0.2	0.4	mA
	V_{IN} = -23V		•		0.2	0.5		0.2	0.5	mA
	$I_O \leq$ 0.5 I_{MAX}, -17.5V $\leq V_{IN} \leq$ -30V				0.1	0.4		0.1	0.4	mA
	$I_O \leq$ 0.5 I_{MAX}, -18.5V $\leq V_{IN} \leq$ -30V		•		0.1	0.5		0.1	1.0	mA
Output Noise Voltage, V_N	10 Hz $\leq f \leq$ 100 kHz, V_{IN} = -23V				90	1200		90	1200	μV
Ripple Rejection, $\triangle V_{IN}/\triangle V_{OUT}$	f = 120 Hz	$I_O \leq I_{MAX}$		56	70		54	70		dB
	-18.5V $\leq V_{IN} \leq$ -28.5V	$I_O \leq$ 0.5 I_{MAX}	•	56	70		54	70		dB
Dropout Voltage	$I_{OUT} = I_{MAX}$				1.1	2.3		1.1	2.3	V
Output Resistance, R_O	f = 1 kHz				9			9		mΩ
Short-Circuit Current, I_{sc}	V_{IN} = -35V				0.6	1.2		0.6	1.2	A
Peak Output Current, I_{pk}	V_{IN} = -23V				2.4	3.3		2.4	3.3	A
Average TC of V_{OUT}	I_O = 5 mA				0.6	6.0		0.6	6.0	mV/°C
Input Voltage Required to Maintain Line Regulation, V_{IN}	$I_O \leq I_{MAX}$			-17.5			-17.5			V

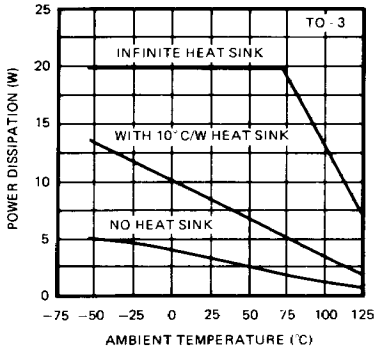
The • denotes the specifications which apply over the full operating temperature range, all others apply at T_j = 25°C unless otherwise specified.

Note 2. All characteristics are measured with a capacitor across the input of 2.2 μF and a capacitor across the output of 0.1 μF. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ($t_W \leq$ 10 ms, duty cycle $\leq$ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

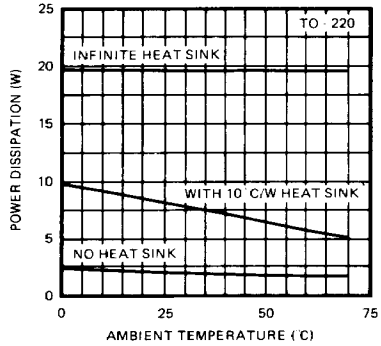
1.5 AMP, 3-TERMINAL NEGATIVE REGULATORS

TYPICAL PERFORMANCE CHARACTERISTICS

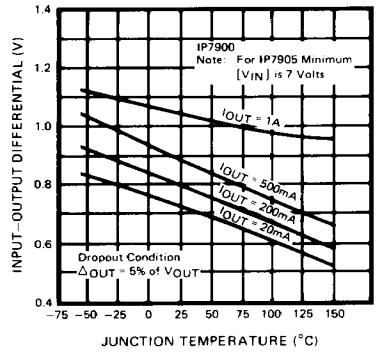
Maximum Average Power Dissipation



Maximum Average Power Dissipation



Dropout Voltage



Peak Output Current