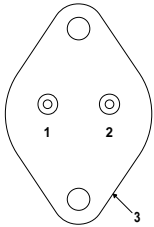
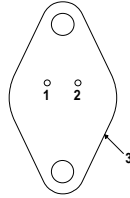


## 1.5 AMP NEGATIVE VOLTAGE REGULATOR



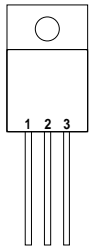
Pin 1 – Ground  
 Pin 2 –  $V_{OUT}$   
 Case –  $V_{IN}$

**K Package – TO-3**



Pin 1 – Ground  
 Pin 2 –  $V_{OUT}$   
 Case –  $V_{IN}$

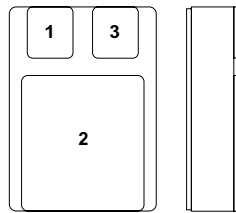
**R Package – TO-66**



Pin 1 – Ground  
 Pin 2 –  $V_{IN}$   
 Pin 3 –  $V_{OUT}$   
 Case –  $V_{IN}$

**G Package – TO-257**  
**IG Package – TO-257\***

\* isolated Case on IG package



Pin 1 – Ground  
 Pin 2 –  $V_{IN}$   
 Pin 3 –  $V_{OUT}$

**SMD Package – SMD1**  
Ceramic Surface Mount

### FEATURES

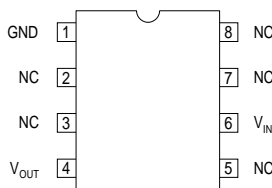
- **OUTPUT VOLTAGES OF -5, -12, -15V**
- **0.01% / V LINE REGULATION**
- **0.3% / A LOAD REGULATION**
- **THERMAL OVERLOAD PROTECTION**
- **SHORT CIRCUIT PROTECTION**
- **OUTPUT TRANSISTOR SOA PROTECTION**
- **1% VOLTAGE TOLERANCE OPTION (-A VERSIONS)**

### DESCRIPTION

The IP120A / LM120 / IP7900A / IP7900 series of 3 terminal regulators is available with several fixed output voltage 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  $\pm 1\%$  output voltage tolerance at room temperature.

Protection features include Safe Operating Area current limiting and thermal shutdown.



**J Package – 8 Pin Cerdip**

### ABSOLUTE MAXIMUM RATINGS ( $T_{case} = 25^{\circ}C$ unless otherwise stated)

$V_I$	DC Input Voltage (for $V_O = -5, -12, -15V$ )	35V
$P_D$	Power Dissipation	Internally limited
$T_j$	Operating Junction Temperature Range	-55 to 150°C
$T_{stg}$	Storage Temperature	-65 to 150°C

Parameter	Test Conditions	IP7905A IP120A-05			IP7905 , IP120-05 LM120-05			Units	
		Min.	Typ.	Max.	Min.	Typ.	Max.		
V <sub>O</sub> Output Voltage	I <sub>O</sub> = 500mA V <sub>IN</sub> = -10V	-4.95	-5	-5.05	-4.9	-5	-5.1	V	
	I <sub>O</sub> = 5mA to I <sub>MAX</sub> P <sub>D</sub> ≤ P <sub>MAX</sub> V <sub>IN</sub> = -7.5V to -20V T <sub>J</sub> = -55 to 150°C	-4.85		-5.15	-4.8		-5.2		
V <sub>O</sub> Low Supply	I <sub>O</sub> = 5mA to I <sub>MAX</sub> V <sub>IN</sub> = -7V to -20V P <sub>D</sub> ≤ P <sub>MAX</sub>	-4.75		-5.15	-4.75		-5.25	V	
ΔV <sub>O</sub> Line Regulation	I <sub>O</sub> = 0.5 I <sub>MAX</sub> V <sub>IN</sub> = -7V to -25V V <sub>IN</sub> = -7.5V to -20V T <sub>J</sub> = -55 to 150°C	3		10	3		25	mV	
		3		10	3		50		
	V <sub>IN</sub> = -8V to -12V I <sub>O</sub> ≤ I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	1		4	1		25		
ΔV <sub>O</sub> Load Regulation	V <sub>IN</sub> = -10V I <sub>O</sub> = 5mA to 1.5A I <sub>O</sub> = 250mA to 750mA	10		25	10		75	mV	
		4		15	4		25		
	V <sub>IN</sub> = -10V I <sub>O</sub> = 5mA to I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	7		25	7		50		
I <sub>Q</sub> Quiescent Current	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> V <sub>IN</sub> = -10V T <sub>J</sub> = -55 to 150°C	1		1.9	1		1.9	mA	
		1		2	1		2		
ΔI <sub>Q</sub> Quiescent Current Change	I <sub>O</sub> = 5mA to I <sub>MAX</sub> V <sub>IN</sub> = -10V T <sub>J</sub> = -55 to 150°C	0.2		0.4	0.2		0.4	mA	
		0.2		0.5	0.2		0.5		
	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	V <sub>IN</sub> = -7V to -25V	0.1		0.4	0.1			0.4
		V <sub>IN</sub> = -8V to -25V	0.1		0.5	0.1			1.0
V <sub>N</sub> Output Noise Voltage	f = 10Hz to 100kHz V <sub>IN</sub> = -10V	40		400	40		400	μV	
ΔV <sub>IN</sub> / ΔV <sub>O</sub> Ripple Rejection	f = 120Hz V <sub>IN</sub> = -8V to -18V I <sub>O</sub> ≤ I <sub>MAX</sub> I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	66		80	54		80	dB	
		66		80	54		80		
Dropout Voltage	I <sub>O</sub> = I <sub>MAX</sub>	1.1		2.3	1.1		2.3	V	
R <sub>O</sub> Output Resistance	f = 1 kHz	5			5			mΩ	
I <sub>sc</sub> Short Circuit Current	V <sub>IN</sub> = -35V	0.6		1.2	0.6		1.2	A	
I <sub>pk</sub> Peak Output Current	V <sub>IN</sub> = -10V	2.4		3.3	2.4		3.3		
Average Temperature Coefficient of V <sub>O</sub>	I <sub>O</sub> = 5mA	0.2		2	0.2		2	mV / °C	
Input Voltage required to maintain line regulation	I <sub>O</sub> ≤ I <sub>MAX</sub>	-7.3			-7.3			V	

1) All characteristics are measured with a capacitor across the input of 0.22μF and a capacitor across the output of 0.1μF.

All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t<sub>p</sub> ≤ 10ms, δ ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

2) Test Conditions unless otherwise stated: P<sub>MAX</sub> = 10W for TO-220SM, P<sub>MAX</sub> = 1W for Cerdip, P<sub>MAX</sub> = 20W for all other package devices  
I<sub>MAX</sub> = 1.0A, T<sub>J</sub> = 25°C

Parameter	Test Conditions	IP7912A IP120A-12			IP7912, IP120-12 LM120-12			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V <sub>O</sub> Output Voltage	I <sub>O</sub> = 500mA V <sub>IN</sub> = -19V	-11.88	-12	-12.12	-11.76	-12	-12.24	V
	V <sub>IN</sub> = -14.8V to -27V P <sub>D</sub> ≤ P <sub>MAX</sub> I <sub>O</sub> = 5mA to I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	-11.64		-12.36	-11.52		-12.48	
V <sub>O</sub> Low Supply	I <sub>O</sub> = 5mA to I <sub>MAX</sub> P <sub>D</sub> ≤ P <sub>MAX</sub> V <sub>IN</sub> = -14.5V to -27V	-11.40		-12.36	-11.40		-12.60	V
ΔV <sub>O</sub> Line Regulation	I <sub>O</sub> = 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = -14.5V to -30V	4	18	4	120	mV	
		V <sub>IN</sub> = -14.8V to -27V T <sub>J</sub> = -55 to 150°C	4	18	4	200		
	I <sub>O</sub> ≤ I <sub>MAX</sub> V <sub>IN</sub> = -16V to -22V T <sub>J</sub> = -55 to 150°C	1	4	1	25			
ΔV <sub>O</sub> Load Regulation	V <sub>IN</sub> = -19V	I <sub>O</sub> = 5mA to 1.5A	12	32	12	80	mV	
		I <sub>O</sub> = 250mA to 750mA	4	19	4	60		
	V <sub>IN</sub> = -19V	I <sub>O</sub> = 5mA to I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	8	60	8	120		
I <sub>Q</sub> Quiescent Current	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> V <sub>IN</sub> = -19V		0.2	0.4		0.2	0.4	mA
	T <sub>J</sub> = -55 to 150°C		1	2		1	2	
ΔI <sub>Q</sub> Quiescent Current Change	I <sub>O</sub> = 5mA to I <sub>MAX</sub> V <sub>IN</sub> = -19V	T <sub>J</sub> = -55 to 150°C	0.2	0.4	0.2	0.4	mA	
		V <sub>IN</sub> = -14.5V to -30V	0.1	0.4	0.1	0.4		
	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = -15V to -30V T <sub>J</sub> = -55 to 150°C	0.1	0.5	0.1	0.5		
		T <sub>J</sub> = -55 to 150°C	0.1	0.5	0.1	1.0		
V <sub>N</sub> Output Noise Voltage	f = 10Hz to 100kHz V <sub>IN</sub> = -19V		75	960		75	960	μV
ΔV <sub>IN</sub> / ΔV <sub>O</sub> Ripple Rejection	f = 120Hz V <sub>IN</sub> = -15V to -25V	I <sub>O</sub> ≤ I <sub>MAX</sub>	58	72	56	72	dB	
		I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	58	72	56	72		
Dropout Voltage	I <sub>O</sub> = I <sub>MAX</sub>		1.1	2.3		1.1	2.3	V
R <sub>O</sub> Output Resistance	f = 1 kHz		8			8		mΩ
I <sub>sc</sub> Short Circuit Current	V <sub>IN</sub> = -35V		0.6	1.2		0.6	1.2	A
I <sub>pk</sub> Peak Output Current	V <sub>IN</sub> = -19V		2.4	3.3		2.4	3.3	
Average Temperature Coefficient of V <sub>O</sub>	I <sub>O</sub> = 5mA		0.5	4.8		0.5	4.8	mV/°C
Input Voltage required to maintain line regulation	I <sub>O</sub> ≤ I <sub>MAX</sub>	-14.5			-14.5			V

1) All characteristics are measured with a capacitor across the input of 0.22μF and a capacitor across the output of 0.1μF.

All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t<sub>p</sub> ≤ 10ms, δ ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

2) Test Conditions unless otherwise stated: P<sub>MAX</sub> = 10W for TO-220SM, P<sub>MAX</sub> = 1W for Cerdip, P<sub>MAX</sub> = 20W for all other package devices  
 I<sub>MAX</sub> = 1.0A, T<sub>J</sub> = 25°C

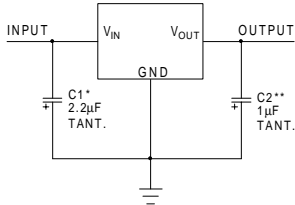
Parameter	Test Conditions	IP7915A IP120A-15			IP7915, IP120-15 LM120-15			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V <sub>O</sub> Output Voltage	I <sub>O</sub> = 500mA V <sub>IN</sub> = -23V	-14.85	-15	-15.15	-14.7	-15	-15.3	V
	V <sub>IN</sub> = -17.9V to -30V P <sub>D</sub> ≤ P <sub>MAX</sub> I <sub>O</sub> = 5mA to I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	-14.55		-15.45	-14.4		-15.6	
V <sub>O</sub> Low Supply	I <sub>O</sub> = 5mA to I <sub>MAX</sub> P <sub>D</sub> ≤ P <sub>MAX</sub> V <sub>IN</sub> = -17.5V to -30V	-14.25		-15.45	-14.25		-15.75	V
ΔV <sub>O</sub> Line Regulation	I <sub>O</sub> = 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = -17.5V to -30V	4	22	4	150	mV	
		V <sub>IN</sub> = -17.9V to -30V T <sub>J</sub> = -55 to 150°C	4	22	4	250		
	I <sub>O</sub> ≤ I <sub>MAX</sub> V <sub>IN</sub> = -20V to -26V T <sub>J</sub> = -55 to 150°C	2	10	2	75			
ΔV <sub>O</sub> Load Regulation	V <sub>IN</sub> = -23V	I <sub>O</sub> = 5mA to 1.5A	12	35	12	80	mV	
		I <sub>O</sub> = 250mA to 750mA	4	21	4	75		
	V <sub>IN</sub> = -23V I <sub>O</sub> = 5mA to I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	9	75	9	150			
I <sub>Q</sub> Quiescent Current	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> V <sub>IN</sub> = -23V T <sub>J</sub> = -55 to 150°C		1	1.9	1	1.9	mA	
			1	2	1	2		
ΔI <sub>Q</sub> Quiescent Current Change	I <sub>O</sub> = 5mA to I <sub>MAX</sub> V <sub>IN</sub> = -23V T <sub>J</sub> = -55 to 150°C		0.2	0.4	0.2	0.4	mA	
			0.2	0.5	0.2	0.5		
	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = -17.5V to -30V	0.1	0.4	0.1	0.4		
		V <sub>IN</sub> = -18.5V to -30V T <sub>J</sub> = -55 to 150°C	0.1	0.5	0.1	1.0		
V <sub>N</sub> Output Noise Voltage	f = 10Hz to 100kHz V <sub>IN</sub> = -23V	90	1200	90	1200	μV		
ΔV <sub>IN</sub> / ΔV <sub>O</sub> Ripple Rejection	f = 120Hz V <sub>IN</sub> = -18.5V to -28.5V	I <sub>O</sub> ≤ I <sub>MAX</sub>	56	70	54	70	dB	
		I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	56	70	54	70		
Dropout Voltage	I <sub>O</sub> = I <sub>MAX</sub>	1.1	2.3	1.1	2.3	V		
R <sub>O</sub> Output Resistance	f = 1 kHz	9		9		mΩ		
I <sub>sc</sub> Short Circuit Current	V <sub>IN</sub> = -35V	0.6	1.2	0.6	1.2	A		
I <sub>pk</sub> Peak Output Current	V <sub>IN</sub> = -23V	2.4	3.3	2.4	3.3			
Average Temperature Coefficient of V <sub>O</sub>	I <sub>O</sub> = 5mA	0.6	6	0.6	6	mV/°C		
Input Voltage required to maintain line regulation	I <sub>O</sub> ≤ I <sub>MAX</sub>	-17.5		-17.5		V		

1) All characteristics are measured with a capacitor across the input of 0.22μF and a capacitor across the output of 0.1μF.

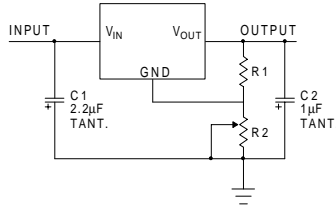
All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t<sub>p</sub> ≤ 10ms, δ ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

2) Test Conditions unless otherwise stated: P<sub>MAX</sub> = 10W for TO-220SM, P<sub>MAX</sub> = 1W for Cerdip, P<sub>MAX</sub> = 20W for all other package devices  
I<sub>MAX</sub> = 1.0A, T<sub>J</sub> = 25°C

**APPLICATIONS INFORMATION**

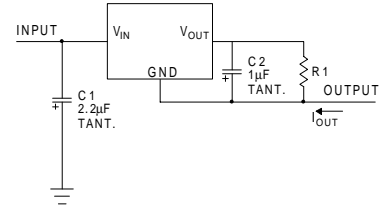


**Fixed Output Regulator**



**Adjustable Output Regulator**

$$V_{OUT} \approx V_{REG} \frac{(R1+R2)}{R1}$$



**Current Regulator**

$$I_{OUT} = \frac{V_{REG}}{R1} + I_Q$$

- \* Required if the regulator is located far from the power supply.
- \*\* Required for stability. 25µF electrolytic may be substituted.

**Order Information**

Part Number	K-Pack (TO-3)	R-Pack (TO-66)	G/IG-Pack (TO-257)	SG-Pack SMD1	J-Pack 8 Pin Cerdip	Temp. Range	<b>Note:</b> To order, add the package identifier to the part number. eg. IP7900AK IP120SG
IP7900A	✓	✓	✓	✓	✓	-55 to +150°C	
IP7900	✓	✓	✓	✓	✓	"	
IP120A	✓	✓	✓	✓	✓	"	
IP120	✓	✓	✓	✓	✓	"	
LM120	✓	✓	✓	✓	✓	"	