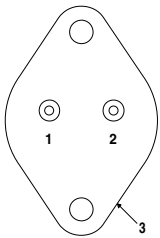
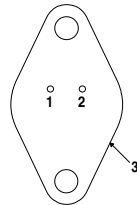


## 1.5 AMP NEGATIVE VOLTAGE REGULATOR



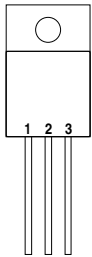
Pin 1 – Ground  
Pin 2 –  $V_{OUT}$   
Case –  $V_{IN}$

**K Package – TO-3**



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

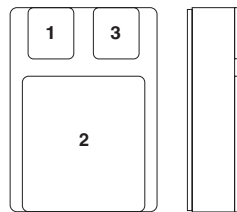
**R Package – TO-66**



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

**TO-257  
TO-220**

Isolated Case Option on  
IG Package



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

**SMD Packages**  
Ceramic Surface Mount

### FEATURES

- **OUTPUT VOLTAGE OF -5V, -12V and -15V**
- **0.7% / V LINE REGULATION AVAILABLE**
- **0.5% / A LOAD REGULATION AVAILABLE**
- **THERMAL OVERLOAD PROTECTION**
- **SHORT CIRCUIT PROTECTION**
- **OUTPUT TRANSISTOR SOA PROTECTION**
- **1.0% VOLTAGE TOLERANCE OPTION ('A' VERSIONS)**

### DESCRIPTION

The IP120 / LM120 / IP7900 / LM7900 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 0.7% / V line regulation, 0.5% / A load regulation and  $\pm 1.0\%$  output voltage tolerance at room temperature.

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

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

$V_I$	DC Input Voltage	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

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Parameter	Test Conditions	IP/LM 7905A Series IP/LM 120A Series			IP/LM 7905 Series IP/LM 120 Series			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	
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	1.0	4	1.0	25			
ΔV <sub>O</sub> Load Regulation	V <sub>IN</sub> = -10V I <sub>O</sub> = 5mA to 1.5A I <sub>O</sub> = 5mA to I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C		25	35		25	100	mV
			25	35		25	100	
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		1.0	1.9		1.0	1.9	mA
			1.0	2		1.0	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	
V <sub>N</sub> Output Noise Voltage	f = 10Hz to 100kHz V <sub>IN</sub> = -10V		100			100	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		58			54	dB	
			58			54		
Dropout Voltage	I <sub>O</sub> = I <sub>MAX</sub>		1.4			1.4	V	
R <sub>O</sub> Output Resistance	f = 1.0 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 Average	V <sub>IN</sub> = -10V		2.4	3.3		2.4	3.3	
Temperature Coefficient of V <sub>O</sub>	I <sub>O</sub> = 5mA		0.2			0.2	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 2.2μF and a capacitor across the output of 1.0μF.  
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 SMD, P<sub>MAX</sub> = 20W for all other package devices

$$I_{MAX} = 1.0A, T_J = 25^\circ C$$

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Parameter	Test Conditions	IP/LM 7912A Series IP/LM120A-12 Series			IP/LM 7912 Series IP/LM120-12 Series			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 V <sub>IN</sub> = -14.8V to -27V T <sub>J</sub> = -55 to 150°C	4		18	4		120	mV
		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	1.0		4	1.0		25	
ΔV <sub>O</sub> Load Regulation	V <sub>IN</sub> = -19V I <sub>O</sub> = 5mA to 1.5A I <sub>O</sub> = 250mA to 750mA	12		32	12		80	mV
		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 T <sub>J</sub> = -55 to 150°C	0.2		0.4	0.2		0.4	mA
	1.0		2	1.0		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
		0.2		0.5	0.2		0.5	
	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> V <sub>IN</sub> = -14.5V to -30V V <sub>IN</sub> = -15V to -30V T <sub>J</sub> = -55 to 150°C	0.1		0.4	0.1		0.4	
V <sub>N</sub> Output Noise Voltage	f = 10Hz to 100kHz V <sub>IN</sub> = -19V		75	960		75	960	μV
	f = 120Hz V <sub>IN</sub> = -15V to -25V 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	58	72		56	72		dB
Dropout Voltage	I <sub>O</sub> = I <sub>MAX</sub>		1.1	2.3		1.1	2.3	
R <sub>O</sub> Output Resistance	f = 1.0 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 2.2μF and a capacitor across the output of 1.0μF.

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 SMD, P<sub>MAX</sub> = 20W for all other package devices, I<sub>MAX</sub> = 1.0A, T<sub>J</sub> = 25°C

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Parameter	Test Conditions	IP/LM 7915A Series IP/LM120A-15 Series			IP/LM 7915 Series IP/LM120-15 Series			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 V <sub>IN</sub> = -17.9V to -30V T <sub>J</sub> = -55 to 150°C	4		22	4		150	mV
		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 I <sub>O</sub> = 250mA to 750mA	12		35	12		80	mV
		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	1.0		1.9	1.0		1.9	mA
	1.0		2	1.0		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 V <sub>IN</sub> = -18.5V to -30V T <sub>J</sub> = -55 to 150°C	0.1		0.4	0.1		0.4	
		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> I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	56		70	54		70	dB
		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 = 1.0 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

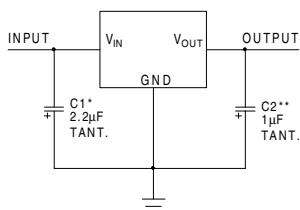
1) All characteristics are measured with a capacitor across the input of 2.2μF and a capacitor across the output of 1.0μF.

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.

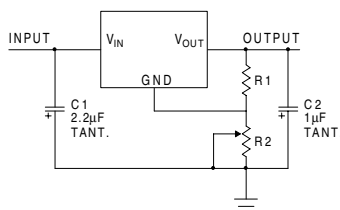
2) Test Conditions unless otherwise stated: P<sub>MAX</sub> = 10W for SMD, P<sub>MAX</sub> = 20W for all other package devices, I<sub>MAX</sub> = 1.0A, T<sub>J</sub> = 25°C

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## APPLICATIONS INFORMATION

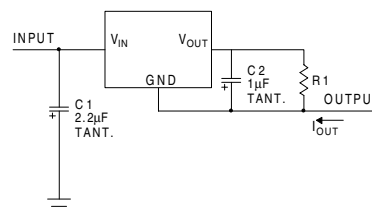


**Fixed Output Regulator**



**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

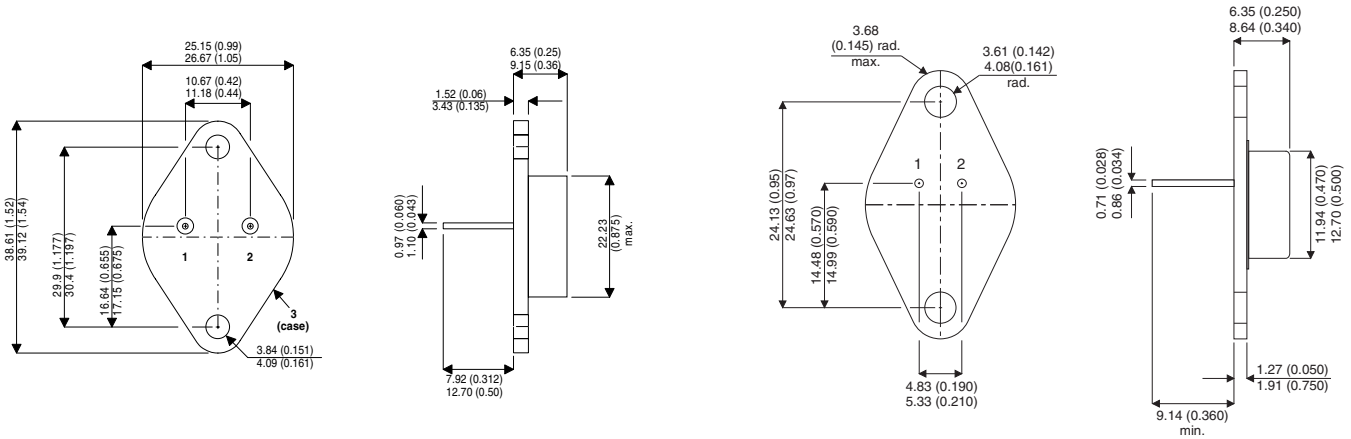
Part Number	K-Pack (TO-3)	R-Pack (TO-66)	G/IG-Pack (TO-257)	220M-Pack (TO-220)	SMD (SMD1)	SMD-05 (SMD 0.5)
IP7905	✓	✓	✓	✓	✓	✓
IP7912	✓	✓	✓	✓	✓	✓
IP7915	✓	✓	✓	✓	✓	✓
IP120-05	✓	✓	✓	✓	✓	✓
IP120-12	✓	✓	✓	✓	✓	✓
IP 120-15	✓	✓	✓	✓	✓	✓
LM7905	✓	✓	✓	✓	✓	✓
LM7912	✓	✓	✓	✓	✓	✓
LM7915	✓	✓	✓	✓	✓	✓
LM120-05	✓	✓	✓	✓	✓	✓
LM120-12	✓	✓	✓	✓	✓	✓
LM120-15	✓	✓	✓	✓	✓	✓

## Order Information

### Note:

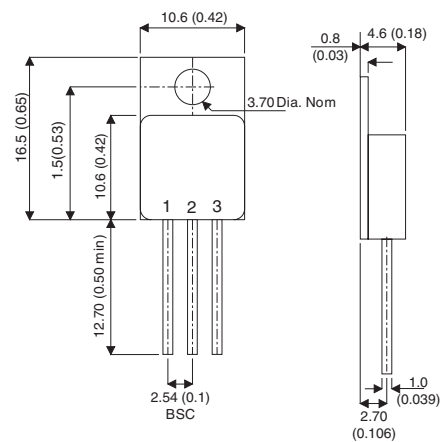
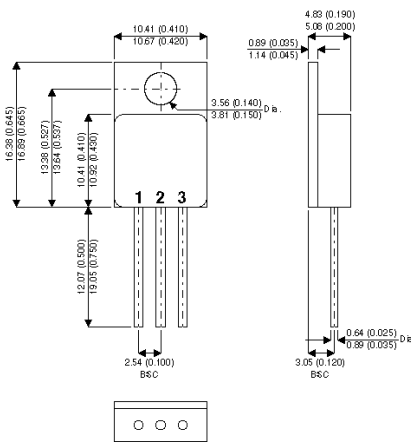
To order, add the package identifier to the part number.  
eg. IP7905AK  
LM120SMD-05

MECHANICAL INFORMATION



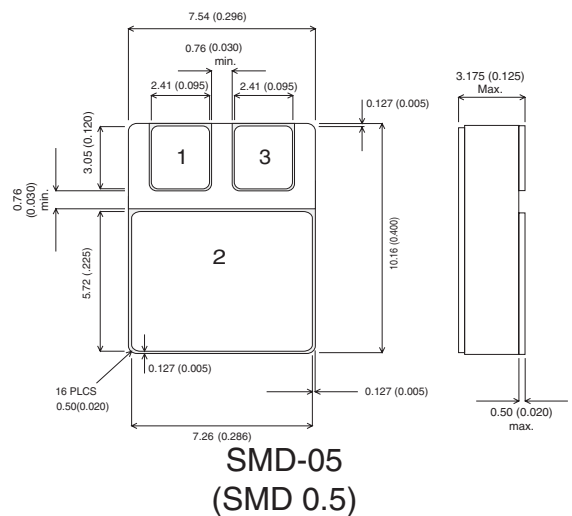
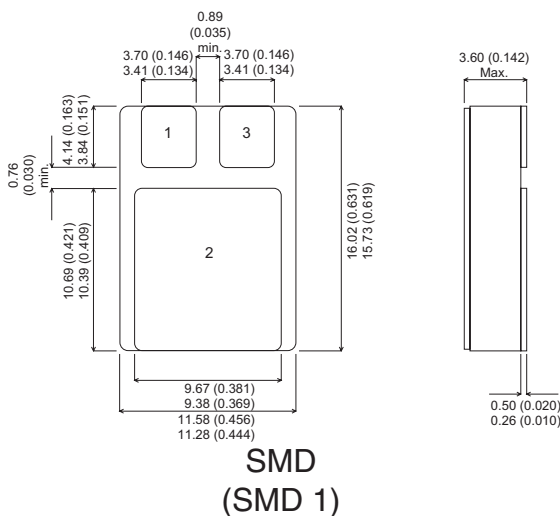
K-Package  
(TO-3)

R-Package  
(TO-66)



G/IG-Package  
(TO-257)

220M-Package  
(TO-220)



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