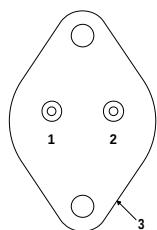
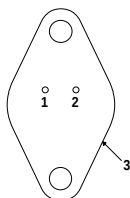


1.5 AMP NEGATIVE VOLTAGE REGULATOR



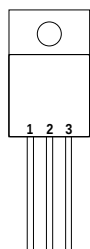
Pin 1 – Ground
Pin 2 – V_{OUT}
Case – V_{IN}

K Package – TO-3



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

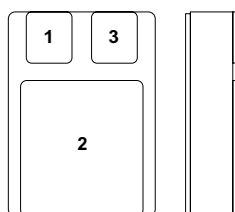
R Package – TO-66



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

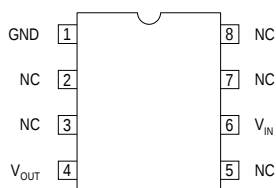
- OUTPUT VOLTAGES OF -5, -12, -15V
- 0.01% / V LINE REGULATION
- 0.3% / A LOAD REGULATION
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSISTOR SOA PROTECTION
- 1% VOLTAGE TOLERANCE OPTION
(-A VERSIONS)

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 $150^{\circ}C$
T_{stg}	Storage Temperature	-65 to $150^{\circ}C$

Parameter	Test Conditions	IP7905A IP120A-05			IP7905 , IP120-05 LM120-05			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V _O Output Voltage	I _O = 500mA V _{IN} = -10V	-4.95	-5	-5.05	-4.9	-5	-5.1	V
	I _O = 5mA to I _{MAX} V _{IN} = -7.5V to -20V P _D ≤ P _{MAX} T _J = -55 to 150°C	-4.85		-5.15	-4.8		-5.2	
V _O Low Supply	I _O = 5mA to I _{MAX} P _D ≤ P _{MAX} V _{IN} = -7V to -20V	-4.75		-5.15	-4.75		-5.25	V
ΔV _O Line Regulation	I _O = 0.5 I _{MAX} V _{IN} = -7V to -25V		3	10		3	25	mV
			3	10		3	50	
	V _{IN} = -8V to -12V		1	4		1	25	
	I _O ≤ I _{MAX} T _J = -55 to 150°C		1	12		2	50	
ΔV _O Load Regulation	V _{IN} = -10V I _O = 5mA to 1.5A		10	25		10	75	mV
			4	15		4	25	
	V _{IN} = -10V I _O = 5mA to I _{MAX} T _J = -55 to 150°C		7	25		7	50	
I _Q Quiescent Current	I _O ≤ 0.5 I _{MAX} V _{IN} = -10V		1	1.9		1	1.9	mA
	T _J = -55 to 150°C		1	2		1	2	
ΔI _Q Quiescent Current Change	I _O = 5mA to I _{MAX} V _{IN} = -10V		0.2	0.4		0.2	0.4	mA
			0.2	0.5		0.2	0.5	
	I _O ≤ 0.5 I _{MAX} V _{IN} = -7V to -25V		0.1	0.4		0.1	0.4	
			0.1	0.5		0.1	1.0	
V _N Output Noise Voltage	f = 10Hz to 100kHz V _{IN} = -10V		40	400		40	400	μV
$\frac{\Delta V_{IN}}{\Delta V_O}$ Ripple Rejection	f = 120Hz V _{IN} = -8V to -18V		66	80		54	80	dB
			66	80		54	80	
Dropout Voltage	I _O = I _{MAX}		1.1	2.3		1.1	2.3	V
R _O Output Resistance	f = 1 kHz		5			5		mΩ
I _{sc} Short Circuit Current	V _{IN} = -35V		0.6	1.2		0.6	1.2	A
I _{pk} Peak Output Current	V _{IN} = -10V		2.4	3.3		2.4	3.3	
Average Temperature Coefficient of V _O	I _O = 5mA		0.2	2		0.2	2	mV/°C
Input Voltage required to maintain line regulation	I _O ≤ I _{MAX}	-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_p ≤ 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_{MAX} = 10W for TO-220SM, P_{MAX} = 1W for Cerdip, P_{MAX} = 20W for all other package devices
I_{MAX} = 1.0A, T_J = 25°C

Parameter	Test Conditions	IP7912A IP120A-12			IP7912, IP120-12 LM120-12			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_O Output Voltage	$I_O = 500\text{mA}$ $V_{IN} = -19\text{V}$	-11.88	-12	-12.12	-11.76	-12	-12.24	V
	$V_{IN} = -14.8\text{V to } -27\text{V}$ $P_D \leq P_{MAX}$ $I_O = 5\text{mA to } I_{MAX}$ $T_J = -55 \text{ to } 150^\circ\text{C}$	-11.64		-12.36	-11.52		-12.48	
V_O Low Supply	$I_O = 5\text{mA to } I_{MAX}$ $P_D \leq P_{MAX}$ $V_{IN} = -14.5\text{V to } -27\text{V}$	-11.40		-12.36	-11.40		-12.60	V
ΔV_O Line Regulation	$I_O = 0.5 I_{MAX}$	$V_{IN} = -14.5\text{V to } -30\text{V}$		4	18	4	120	mV
		$V_{IN} = -14.8\text{V to } -27\text{V}$ $T_J = -55 \text{ to } 150^\circ\text{C}$		4	18	4	200	
	$I_O \leq I_{MAX}$ $V_{IN} = -16\text{V to } -22\text{V}$	$T_J = -55 \text{ to } 150^\circ\text{C}$		1	4	1	25	
				2	9	2	60	
ΔV_O Load Regulation	$V_{IN} = -19\text{V}$	$I_O = 5\text{mA to } 1.5\text{A}$		12	32	12	80	mV
		$I_O = 250\text{mA to } 750\text{mA}$		4	19	4	60	
	$V_{IN} = -19\text{V}$	$I_O = 5\text{mA to } I_{MAX}$ $T_J = -55 \text{ to } 150^\circ\text{C}$		8	60	8	120	
I_Q Quiescent Current	$I_O \leq 0.5 I_{MAX}$ $V_{IN} = -19\text{V}$	$T_J = -55 \text{ to } 150^\circ\text{C}$		0.2	0.4	0.2	0.4	mA
				1	2	1	2	
ΔI_Q Quiescent Current Change	$I_O = 5\text{mA to } I_{MAX}$ $V_{IN} = -19\text{V}$	$T_J = -55 \text{ to } 150^\circ\text{C}$		0.2	0.4	0.2	0.4	mA
				0.2	0.5	0.2	0.5	
	$I_O \leq 0.5 I_{MAX}$	$V_{IN} = -14.5\text{V to } -30\text{V}$		0.1	0.4	0.1	0.4	
		$V_{IN} = -15\text{V to } -30\text{V}$ $T_J = -55 \text{ to } 150^\circ\text{C}$		0.1	0.5	0.1	1.0	
V_N Output Noise Voltage	$f = 10\text{Hz to } 100\text{kHz}$ $V_{IN} = -19\text{V}$	75	960		75	960		μV
$\frac{\Delta V_{IN}}{\Delta V_O}$ Ripple Rejection	$f = 120\text{Hz}$	$I_O \leq I_{MAX}$		58	72	56	72	dB
	$V_{IN} = -15\text{V to } -25\text{V}$	$I_O \leq 0.5 I_{MAX}$ $T_J = -55 \text{ to } 150^\circ\text{C}$		58	72	56	72	
Dropout Voltage	$I_O = I_{MAX}$	1.1	2.3		1.1	2.3		V
R_O Output Resistance	$f = 1 \text{ kHz}$	8			8			$\text{m}\Omega$
I_{sc} Short Circuit Current	$V_{IN} = -35\text{V}$	0.6	1.2		0.6	1.2		A
I_{pk} Peak Output Current	$V_{IN} = -19\text{V}$	2.4	3.3		2.4	3.3		
Average Temperature Coefficient of V_O	$I_O = 5\text{mA}$	0.5	4.8		0.5	4.8		$\text{mV}/^\circ\text{C}$
Input Voltage required to maintain line regulation	$I_O \leq I_{MAX}$	-14.5			-14.5			V

1) All characteristics are measured with a capacitor across the input of $0.22\mu\text{F}$ and a capacitor across the output of $0.1\mu\text{F}$.

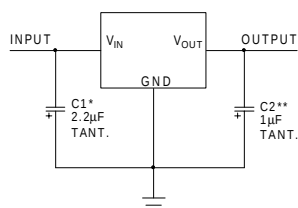
All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ($t_p \leq 10\text{ms}$, $\delta \leq 5\%$). Output voltage changes due to changes in internal temperature must be taken into account separately.

2) Test Conditions unless otherwise stated: $P_{MAX} = 10\text{W}$ for TO-220SM, $P_{MAX} = 1\text{W}$ for Cerdip, $P_{MAX} = 20\text{W}$ for all other package devices
 $I_{MAX} = 1.0\text{A}$, $T_J = 25^\circ\text{C}$

Parameter	Test Conditions	IP7915A IP120A-15			IP7915, IP120-15 LM120-15			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V _O Output Voltage	I _O = 500mA V _{IN} = -23V	-14.85	-15	-15.15	-14.7	-15	-15.3	V
	V _{IN} = -17.9V to -30V P _D ≤ P _{MAX} I _O = 5mA to I _{MAX} T _J = -55 to 150°C	-14.55		-15.45	-14.4		-15.6	
V _O Low Supply	I _O = 5mA to I _{MAX} P _D ≤ P _{MAX} V _{IN} = -17.5V to -30V	-14.25		-15.45	-14.25		-15.75	V
ΔV _O Line Regulation	I _O = 0.5 I _{MAX}	V _{IN} = -17.5V to -30V		4	22	4	150	mV
		V _{IN} = -17.9V to -30V T _J = -55 to 150°C		4	22	4	250	
	I _O ≤ I _{MAX} V _{IN} = -20V to -26V	T _J = -55 to 150°C		2	10	2	75	
		T _J = -55 to 150°C		5	30	5	150	
ΔV _O Load Regulation	V _{IN} = -23V	I _O = 5mA to 1.5A		12	35	12	80	mV
		I _O = 250mA to 750mA		4	21	4	75	
	V _{IN} = -23V	I _O = 5mA to I _{MAX} T _J = -55 to 150°C		9	75	9	150	
I _Q Quiescent Current	I _O ≤ 0.5 I _{MAX} V _{IN} = -23V	T _J = -55 to 150°C		1	1.9	1	1.9	mA
		T _J = -55 to 150°C		1	2	1	2	
ΔI _Q Quiescent Current Change	I _O = 5mA to I _{MAX} V _{IN} = -23V	T _J = -55 to 150°C		0.2	0.4	0.2	0.4	mA
		T _J = -55 to 150°C		0.2	0.5	0.2	0.5	
	I _O ≤ 0.5 I _{MAX}	V _{IN} = -17.5V to -30V		0.1	0.4	0.1	0.4	
		V _{IN} = -18.5V to -30V T _J = -55 to 150°C		0.1	0.5	0.1	1.0	
V _N Output Noise Voltage	f = 10Hz to 100kHz V _{IN} = -23V	90	1200		90	1200		μV
$\frac{\Delta V_{IN}}{\Delta V_O}$ Ripple Rejection	f = 120Hz V _{IN} = -18.5V to -28.5V	I _O ≤ I _{MAX}		56	70	54	70	dB
		I _O ≤ 0.5 I _{MAX} T _J = -55 to 150°C		56	70	54	70	
Dropout Voltage	I _O = I _{MAX}	1.1	2.3		1.1	2.3		V
R _O Output Resistance	f = 1 kHz	9			9			mΩ
I _{sc} Short Circuit Current	V _{IN} = -35V	0.6	1.2		0.6	1.2		A
I _{pk} Peak Output Current	V _{IN} = -23V	2.4	3.3		2.4	3.3		
Average Temperature Coefficient of V _O	I _O = 5mA	0.6	6		0.6	6		mV/°C
Input Voltage required to maintain line regulation	I _O ≤ I _{MAX}	-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_p ≤ 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_{MAX} = 10W for TO-220SM, P_{MAX} = 1W for Cerdip, P_{MAX} = 20W for all other package devices
 I_{MAX} = 1.0A, T_J = 25°C

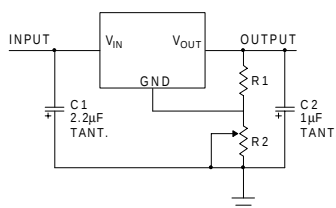
APPLICATIONS INFORMATION



Fixed Output Regulator

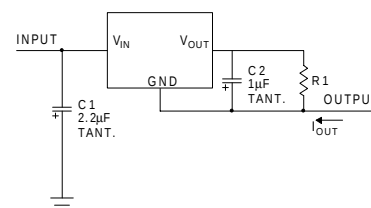
* Required if the regulator is located far from the power supply.

** Required for stability. 25µF electrolytic may be substituted.



Adjustable Output Regulator

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



Current Regulator

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

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	Note: To order, add the package identifier to the part number. eg. IP7900AK IP120SG
IP7900A	✓	✓	✓	✓	✓	-55 to +150°C	
IP7900	✓	✓	✓	✓	✓	"	
IP120A	✓	✓	✓	✓	✓	"	
IP120	✓	✓	✓	✓	✓	"	
LM120	✓	✓	✓	✓	✓	"	