3 AMP, 3-TERMINAL, FIXED NEGATIVE VOLTAGE REGULATORS

IP1R17, IP3R17, IP1R17A, IP3R17A

DESCRIPTION

The IP1R17A/IP3R17A and IP1R17/IP3R17 series of fixed three terminal negative regulators are capable of delivering 3 amps of output current, and are available with several convenient output voltages. The A-suffix devices provide 0.01%/V line regulation, 0.5% load regulation, and a ±1% output voltage tolerance at room temperature. Over all specified operating conditions (load, line, power, and temperature), the output voltage is guaranteed not to vary by more than ±3%. Protection features include safe operating area current limiting for the output power transistor, and thermal shutdown. The entire series of regulators is available in a TO-3 package, and the commercial version is also available in a convenient, low cost plastic TO-220 package. For military applications the space saving Hermetic TO220 (TO257) is available.

FEATURES

- 3 Amp output current capability
- ± 1% Output tolerance at room temperature (A suffix)
- 0.01%/V Line regulation
- 0.5% Load regulation
- −5, −5.2, −12, −15 Volt fixed output voltages available
- Short circuit current limit protection
- Safe operating area protection
- Thermal shutdown protection
- Improved version of LM145

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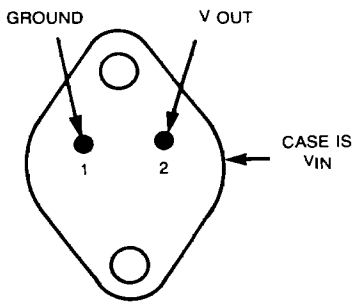
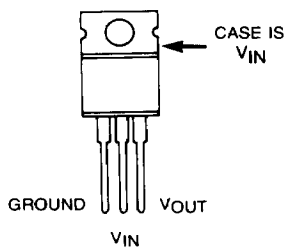
PACKAGE INFORMATION

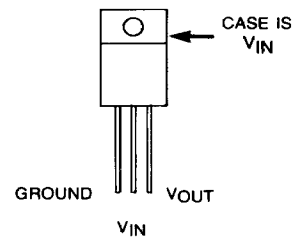
BOTTOM VIEW
TO-3 (K PACKAGE)



TOP VIEW
TO-220



TOP VIEW
TO-257



3 AMP, 3-TERMINAL, FIXED NEGATIVE VOLTAGE REGULATORS

ABSOLUTE MAXIMUM RATINGS

Input Voltage (V_{OUT} = −5, −5.2, −12, or −15V) 35V

Power Dissipation Internally Limited

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

Lead Temperature (Soldering, 10 sec) 300°C

Operating Junction Temperature Range

IP1R17A/IP1R17 −55°C to +150°C

IP3R17A/IP3R17 0°C to +125°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.

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions (Note 1)		IP1R17A-5/IP3R17A-5 Min	Typ	Max	IP1R17-5/IP3R17-5 Min	Typ	Max	Units
V_{OUT}	Output Voltage			-5.05	-5.00	-4.95	-5.15	-5.00	-4.85	V
		-5mA ≥ I_{OUT} ≥ -3A, -8V ≥ V_{IN} ≥ -20V, P ≤ P_{MAX}	•	-5.15		-4.85	-5.25		-4.75	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	I_{OUT} = -5mA (Note 2)			3	15		6	30	mV
		-7.5V ≥ V_{IN} ≥ -35V	•		6	30		12	60	mV
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	-5mA ≥ I_{OUT} ≥ -3A			5	25		10	50	mV
		(Note 2)	•		10	50		20	100	mV
I_Q	Quiescent Current	I_{OUT} = -5mA	•			5			5	mA
ΔI_Q	Quiescent Current	-5mA ≥ I_{OUT} ≥ -3A	•			10			10	mA
	Change (Load/Line)	I_{OUT} = -5mA, -7.5V ≥ V_{IN} ≥ -35V	•			5			5	mA
V_D	Dropout Voltage	I_{OUT} = -3A, ΔV_{OUT} = 100mV	•		2.2	3.0		2.2	3.0	V
	Ripple Rejection	I_{OUT} = -1A, f = 120Hz	•	60	80		60	80		dB
	Thermal Regulation	t_{PULSE} = 20msec, $\Delta P = P_{MAX}$			0.002	0.01		0.002	0.02	%/W
I_{PEAK}	Peak Output Current (dc)	V_{IN} = -10V	•	-6.5	-4.5		-6.5	-4.5		A
I_{SC}	Short Circuit	V_{IN} = -10V			-4			-4		A
	Current	V_{IN} = -35V			-1			-1		A
e_n	Output Noise Voltage	10Hz ≤ f ≤ 100kHz			40			40		μV
	AVE TC of V_{OUT}									mV
Θ_{JC}	Thermal Resistance,	K Package			1.5	2.5		1.5	2.5	°C/W
	Junction to Case	G, T Package			3	4		3	4	°C/W
										°C/W

The • denotes specifications which apply over the full operating junction temperature range. All others apply at T_{CASE} = 25°C unless otherwise specified.

Note 1: Unless otherwise specified, V_{IN} = −10V, and I_{OUT} = −1.5A. Although power dissipation is internally limited, these specifications apply for dissipations up to 30W for the TO−3 package, and for dissipations up to 20W for the TO−220 and TO-257.

Note 2: Load and line regulation are electrically independent and are measured using pulse testing techniques at low duty cycle in order to maintain constant junction temperature. To determine the effects on the output voltage due to device heating refer to the thermal regulation specification.

3 AMP, 3-TERMINAL, FIXED NEGATIVE VOLTAGE REGULATORS

ELECTRICAL CHARACTERISTICS (CONTINUED)

Symbol	Parameter	Conditions (Note 1)		IP1R17A-5.2/IP3R17A-5.2 Min	Typ	Max	IP1R17-5.2/IP3R17-5.2 Min	Typ	Max	Units
V_{OUT}	Output Voltage			-5.25	-5.20	-5.15	-5.35	-5.20	-5.05	V
		-5mA ≥ I_{OUT} ≥ -3A -8.2V ≥ V_{IN} ≥ 20V, P ≤ P_{MAX}	•	-5.35		-5.05	-5.45		-4.95	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	I_{OUT} = -5mA (Note 2)			3	15		6	30	mV
		-7.7V ≥ V_{IN} ≥ -35V	•		6	30		12	60	mV
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	-5mA ≥ I_{OUT} ≥ -3A			5	25		10	50	mV
		(Note 2)	•		10	50		20	100	mV
I_Q	Quiescent Current	I_{OUT} = -5mA	•			5			5	mA
ΔI_Q	Quiescent Current	-5mA ≥ I_{OUT} ≥ -3A	•			10			10	mA
	Change (Load/Line)	I_{OUT} = -5mA, -7.7V ≥ V_{IN} ≥ -35V	•			5			5	mA
V_D	Dropout Voltage	I_{OUT} = -3A, ΔV_{OUT} = 100mV	•		2.2	3.0		2.2	3.0	V
	Ripple Rejection	I_{OUT} = -1A, f = 120Hz	•	60	80		60	80		dB
	Thermal Regulation	t_{PULSE} = 20msec, $\Delta P = P_{MAX}$			0.002	0.01		0.002	0.02	%/W
I_{PEAK}	Peak Output Current (dc)	V_{IN} = -10V	•	-6.5	-4.5		-6.5	-4.5		A
I_{SC}	Short Circuit	V_{IN} = -10V			-4			-4		A
	Current	V_{IN} = -35V			-1			-1		A
e_n	Output Noise Voltage	10Hz ≤ f ≤ 100kHz			40			40		μV
	AVE TC of V_{OUT}									mV
θ_{JC}	Thermal Resistance,	K Package			1.5	2.5		1.5	2.5	°C/W
	Junction to Case	G, T Package			3	4		3	4	°C/W
										°C/W

The • denotes specifications which apply over the full operating junction temperature range. All others apply at T_{CASE} = 25°C unless otherwise specified.

Note 1: Unless otherwise specified, V_{IN} = −10V, and I_{OUT} = −1.5A. Although power dissipation is internally limited, these specifications apply for dissipations up to 30W for the TO−3 package, and for dissipations up to 20W for the TO−220 and TO-257.

Note 2: Load and line regulation are electrically independent and are measured using pulse testing techniques at low duty cycle in order to maintain constant junction temperature. To determine the effects on the output voltage due to device heating refer to the thermal regulation specification.

3 AMP, 3-TERMINAL, FIXED NEGATIVE VOLTAGE REGULATORS

ELECTRICAL CHARACTERISTICS (CONTINUED)

Symbol	Parameter	Conditions (Note 1)		IP1R17A-12/IP3R17A-12 Min	Typ	Max	IP1R17-12/IP3R17-12 Min	Typ	Max	Units
				-12.12	-12.00	-11.88	-12.36	-12.00	-11.64	V
V_{OUT}	Output Voltage	-5mA ≥ I_{OUT} ≥ -3A -15V ≥ V_{IN} ≥ -27V, P ≤ P_{MAX}	•	-12.36		-11.64	-12.60		-11.40	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	I_{OUT} = -5mA (Note 2)			5	30		10	60	mV
		-14.5V ≥ V_{IN} ≥ -35V	•		10	60		20	120	mV
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	-5mA ≥ I_{OUT} ≥ -3A			10	60		20	120	mV
		(Note 2)	•		20	120		40	240	mV
I_Q	Quiescent Current	I_{OUT} = -5mA	•			5			5	mA
ΔI_Q	Quiescent Current	-5mA ≥ I_{OUT} ≥ -3A	•			10			10	mA
	Change (Load/Line)	I_{OUT} = -5mA, -14.5V ≥ V_{IN} ≥ -35V	•			5			5	mA
V_D	Dropout Voltage	I_{OUT} = -3A, ΔV_{OUT} = 250mV	•		2.2	3.0		2.2	3.0	V
	Ripple Rejection	I_{OUT} = -1A, f = 120Hz	•	52	72		52	72		dB
	Thermal Regulation	t_{PULSE} = 20msec, $\Delta P = P_{MAX}$			0.002	0.01		0.002	0.02	%/W
I_{PEAK}	Peak Output Current (dc)	V_{IN} = -17V	•	-6.5	-4.5		-6.5	-4.5		A
I_{SC}	Short Circuit	V_{IN} = -17V			-2.5			-2.5		A
	Current	V_{IN} = -35V			-1			-1		A
e_n	Output Noise Voltage	10Hz ≤ f ≤ 100kHz			75			75		μV
	AVE TC of V_{OUT}									mV
θ_{JC}	Thermal Resistance,	K Package			1.5	2.5		1.5	2.5	°C/W
	Junction to Case	G, T Package			3	4		3	4	°C/W
										°C/W

The • denotes specifications which apply over the full operating junction temperature range. All others apply at T_{CASE} = 25°C unless otherwise specified.

Note 1: Unless otherwise specified, V_{IN} = −17V, and I_{OUT} = −1.5A. Although power dissipation is internally limited, these specifications apply for dissipations up to 30W for the TO−3 package, and for dissipations up to 20W for the TO−220 and TO-257.

Note 2: Load and line regulation are electrically independent and are measured using pulse testing techniques at low duty cycle in order to maintain constant junction temperature. To determine the effects on the output voltage due to device heating refer to the thermal regulation specification.

3 AMP, 3-TERMINAL, FIXED NEGATIVE VOLTAGE REGULATORS

ELECTRICAL CHARACTERISTICS (CONTINUED)

Symbol	Parameter	Conditions (Note 1)		IP1R17A-15/IP3R17A-15 Min	Typ	Max	IP1R17-15/IP3R17-15 Min	Typ	Max	Units
V_{OUT}	Output Voltage			-15.15	-15.00	-14.85	-15.45	-15.00	-14.55	V
		-5mA ≥ I_{OUT} ≥ -3A -18V ≥ V_{IN} ≥ -30V, P < P_{MAX}	•	-15.45		-14.55	-15.75		-14.25	V
$\triangle V_{OUT}$ / $\triangle V_{IN}$	Line Regulation	I_{OUT} = -5mA (Note 2)			8	40		16	80	mV
		-17.5V ≥ V_{IN} ≥ -35V	•		16	80		32	160	mV
$\triangle V_{OUT}$ / $\triangle I_{OUT}$	Load Regulation	-5mA ≥ I_{OUT} ≥ -3A			16	80		32	160	mV
		(Note 2)	•		32	160		64	320	mV
I_Q	Quiescent Current	I_{OUT} = -5mA	•			5			5	mA
$\triangle I_Q$	Quiescent Current	-5mA ≥ I_{OUT} ≥ -3A	•			10			10	mA
	Change (Load/Line)	I_{OUT} = -5mA, -17.5V ≥ V_{IN} ≥ -35V	•			5			5	mA
V_D	Dropout Voltage	I_{OUT} = -3A, $\triangle V_{OUT}$ = 300mV	•		2.2	3.0		2.2	3.0	V
	Ripple Rejection	I_{OUT} = -1A, f = 120Hz	•	50	70		50	70		dB
	Thermal Regulation	t_{PULSE} = 20msec, $\triangle P = P_{MAX}$			0.002	0.01		0.002	0.02	%/W
I_{PEAK}	Peak Output Current (dc)	V_{IN} = -20V	•	-6.5	-4.5		-6.5	-4.5		A
I_{SC}	Short Circuit	V_{IN} = -20V			-2.3			-2.3		A
	Current	V_{IN} = -35V			-1			-1		A
e_n	Output Noise Voltage	10Hz ≤ f ≤ 100kHz			90			90		µV
	AVE TC of V_{OUT}									mV
Θ_{JC}	Thermal Resistance,	K Package			1.5	2.5		1.5	2.5	°C/W
	Junction to Case	G, T Package			3	4		3	4	°C/W
										°C/W

The • denotes specifications which apply over the full operating junction temperature range. All others apply at T_{CASE} = 25°C unless otherwise specified.

Note 1: Unless otherwise specified, V_{IN} = −20V, and I_{OUT} = −1.5A. Although power dissipation is internally limited, these specifications apply for dissipations up to 30W for the TO−3 package, and for dissipations up to 20W for the TO−220 and TO-257.

Note 2: Load and line regulation are electrically independent and are measured using pulse testing techniques at low duty cycle in order to maintain constant junction temperature. To determine the effects on the output voltage due to device heating refer to the thermal regulation specification.

ORDER INFORMATION

Part Number	Temperature Range	Package
IP1R17AK-XX, IP1R17K-XX	−55°C to +150°C	TO-3
IP1R17AG-XX, IP1R17G-XX	−55°C to +150°C	TO-257
IP3R17AK-XX, IP3R17K-XX	0°C to +125°C	TO-3
IP3R17AT-XX, IP3R17T-XX	0°C to +125°C	TO-220