National Semiconductor

February 1995

LM320L, LM79LXXAC Series 3-Terminal Negative Regulators

General Description

The LM320L/LM79LXXAC series of 3-terminal negative voltage regulators features fixed output voltages of −5V, −12V, and −15V with output current capabilities in excess of 100 mA. These devices were designed using the latest computer techniques for optimizing the packaged IC thermal/electrical performance. The LM79LXXAC series, even when combined with a minimum output compensation capacitor of 0.1 μF, exhibits an excellent transient response, a maximum line regulation of 0.07% V_O/V, and a maximum load regulation of 0.01% V_O/mA.

The LM320L/LM79LXXAC series also includes, as self-protection circuitry: safe operating area circuitry for output transistor power dissipation limiting, a temperature independent short circuit current limit for peak output current limiting, and a thermal shutdown circuit to prevent excessive junction temperature. Although designed primarily as fixed voltage regulators, these devices may be combined with simple external circuitry for boosted and/or adjustable voltages and currents. The LM79LXXAC series is available in the 3-lead TO-92 package, and SO-8; 8 lead package. The LM320L series is available in the 3-lead TO-92 package.

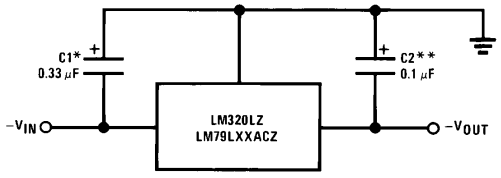
For output voltage other than −5V, −12V and −15V the LM137L series provides an output voltage range from 1.2V to 47V.

Features

- Preset output voltage error is less than ±5% overload, line and temperature
- Specified at an output current of 100 mA
- Easily compensated with a small 0.1 μF output capacitor
- Internal short-circuit, thermal and safe operating area protection
- Easily adjustable to higher output voltages
- Maximum line regulation less than 0.07% V_{OUT}/V
- Maximum load regulation less than 0.01% V_{OUT}/mA

Typical Applications

Fixed Output Regulator



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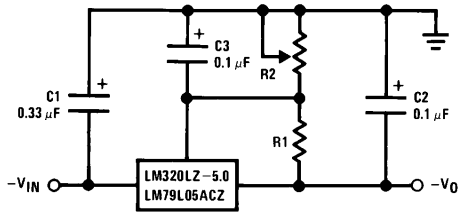
*Required if the regulator is located far from the power supply filter. A 1 μF aluminum electrolytic may be substituted.

**Required for stability. A 1 μF aluminum electrolytic may be substituted.

Adjustable Output Regulator



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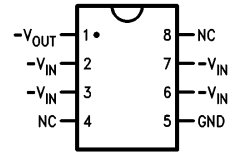
$-V_O = -5V - (5V/R1 + I_Q) \bullet R2$,
$5V/R1 > 3\ I_Q$

Connection Diagrams

SO-8 Plastic (Narrow Body)



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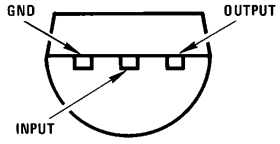
Top View

Order Number LM79L05ACM, LM79L12ACM or LM79L15ACM
See NS Package Number M08A

TO-92 Plastic Package (Z)



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Bottom View

Order Number LM320LZ-5.0, LM79L05ACZ, LM320LZ-12, LM79L12ACZ, LM320LZ-15 or LM79L15ACZ
See NS Package Number Z03A

RRD-B30M115/Printed in U. S. A.

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Input Voltage	
$V_O = -5V, -12V, -15V$	$-35V$
Internal Power Dissipation (Note 1)	Internally Limited
Operating Temperature Range	0°C to +70°C
Maximum Junction Temperature	+125°C
Storage Temperature Range	−55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	260°C

Electrical Characteristics (Note 2) $T_A = 0°C$ to $+70°C$ unless otherwise noted.

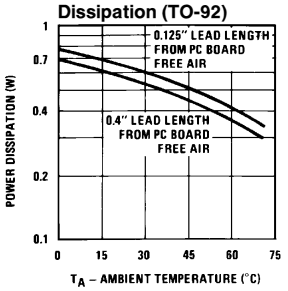
Output Voltage			−5V			−12V			−15V			Units
Input Voltage (unless otherwise noted)			−10V			−17V			−20V			
Symbol	Parameter	Conditions	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_O	Output Voltage	$T_j = 25°C$, $I_O = 100$ mA	−5.2	−5	−4.8	−12.5	−12	−11.5	−15.6	−15	−14.4	
		$1 mA \le I_O \le 100$ mA $V_{MIN} \le V_{IN} \le V_{MAX}$	−5.25 $(-20 \le V_{IN} \le -7.5)$		−4.75	−12.6 $(-27 \le V_{IN} \le -14.8)$		−11.4	−15.75 $(-30 \le V_{IN} \le -18)$		−14.25	V
		$1 mA \le I_O \le 40$ mA $V_{MIN} \le V_{IN} \le V_{MAX}$	−5.25 $(-20 \le V_{IN} \le -7)$		−4.75	−12.6 $(-27 \le V_{IN} \le -14.5)$		−11.4	−15.75 $(-30 \le V_{IN} \le -17.5)$		−14.25	
ΔV_O	Line Regulation	$T_j = 25°C$, $I_O = 100$ mA $V_{MIN} \le V_{IN} \le V_{MAX}$			60 $(-20 \le V_{IN} \le -7.3)$			45 $(-27 \le V_{IN} \le -14.6)$			45 $(-30 \le V_{IN} \le -17.7)$	mV V
		$T_j = 25°C$, $I_O = 40$ mA $V_{MIN} \le V_{IN} \le V_{MAX}$			60 $(-20 \le V_{IN} \le -7)$			45 $(-27 \le V_{IN} \le -14.5)$			45 $(-30 \le V_{IN} \le -17.5)$	mV V
ΔV_O	Load Regulation	$T_j = 25°C$ $1 mA \le I_O \le 100$ mA			50			100			125	mV
ΔV_O	Long Term Stability	$I_O = 100$ mA		20			48			60		mV/khrs
I_Q	Quiescent Current	$I_O = 100$ mA		2	6		2	6		2	6	mA
ΔI_Q	Quiescent Current Change	$1 mA \le I_O \le 100$ mA			0.3			0.3			0.3	mA
		$1 mA \le I_O \le 40$ mA			0.1			0.1			0.1	
		$I_O = 100$ mA			0.25			0.25			0.25	mA
		$V_{MIN} \le V_{IN} \le V_{MAX}$	$(-20 \le V_{IN} \le -7.5)$			$(-27 \le V_{IN} \le -14.8)$			$(-30 \le V_{IN} \le -18)$			V
V_n	Output Noise Voltage	$T_j = 25°C$, $I_O = 100$ mA $f = 10$ Hz − 10 kHz		40			96			120		μV
$\frac{\Delta V_{IN}}{\Delta V_O}$	Ripple Rejection	$T_j = 25°C$, $I_O = 100$ mA $f = 120$ Hz	50			52			50			dB
	Input Voltage Required to Maintain Line Regulation	$T_j = 25°C$, $I_O = 100$ mA			−7.3			−14.6			−17.7	V
		$I_O = 40$ mA			−7.0			−14.5			−17.5	V

Note 1: Thermal resistance of Z package is 60°C/W θ_{jc}, 232°C/W θ_{ja} at still air, and 88°C/W at 400 ft/min of air. The M package θ_{ja} is 180°C/W in still air. The maximum junction temperature shall not exceed 125°C on electrical parameters.

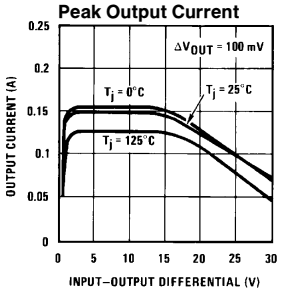
Note 2: To ensure constant junction temperature, low duty cycle pulse testing is used.

Typical Performance Characteristics

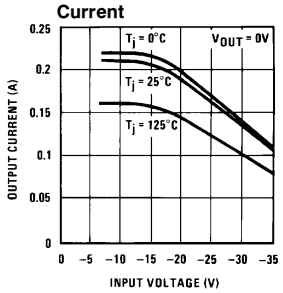
Maximum Average Power Dissipation (TO-92)



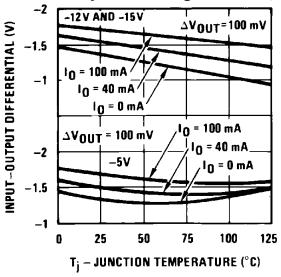
Peak Output Current



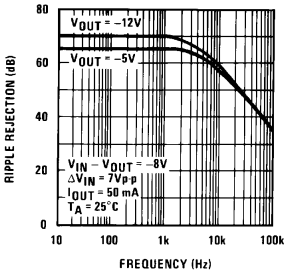
Short Circuit Output Current



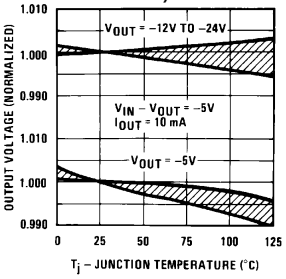
Dropout Voltage



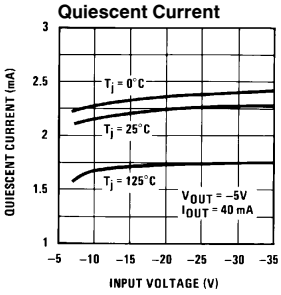
Ripple Rejection



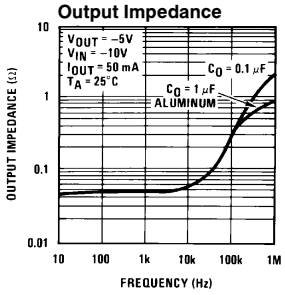
Output Voltage vs. Temperature (Normalized to 1V @ 25°C)



Quiescent Current



Output Impedance



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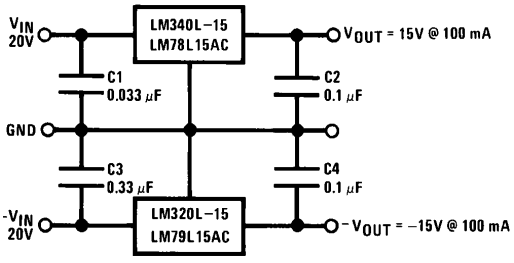
Typical Applications (Continued)

± 15V, 100 mA Dual Power Supply



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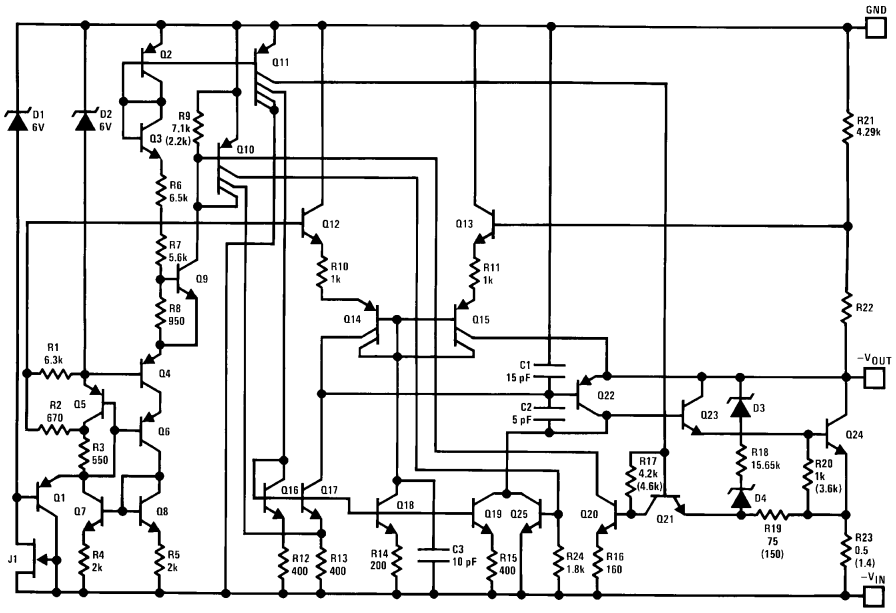
Schematic Diagrams

−5V



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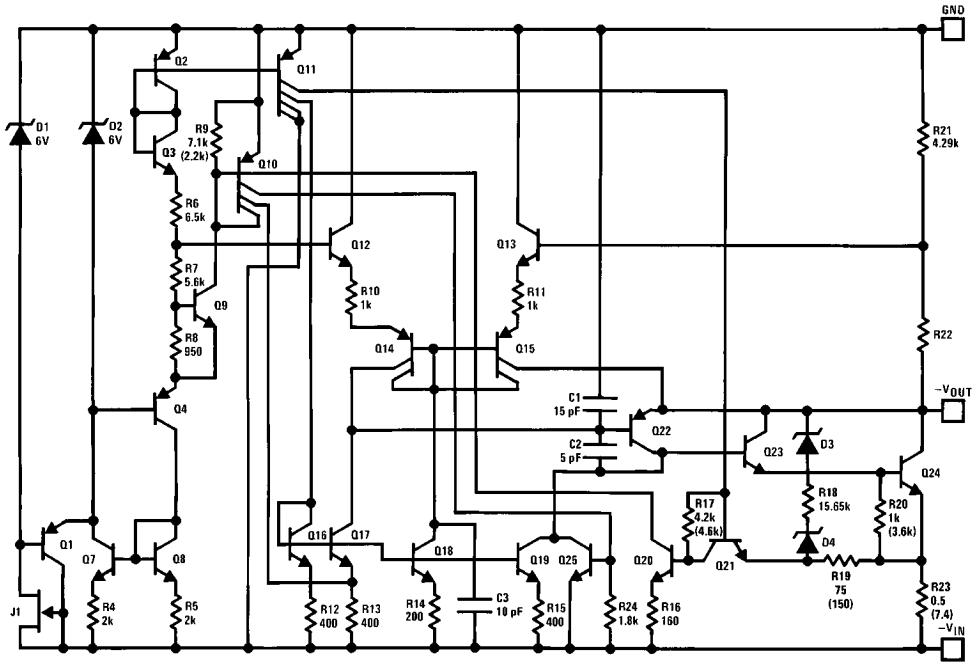
−12V and −15V



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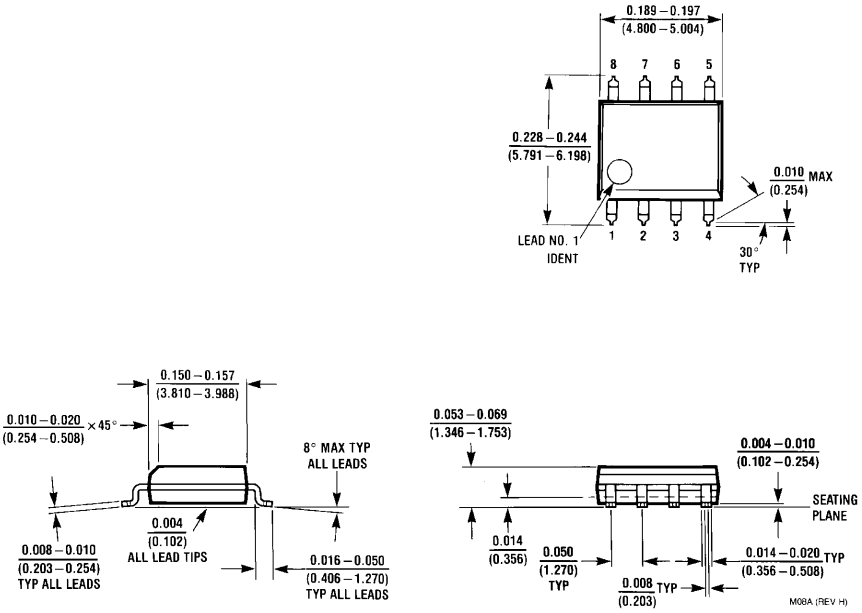
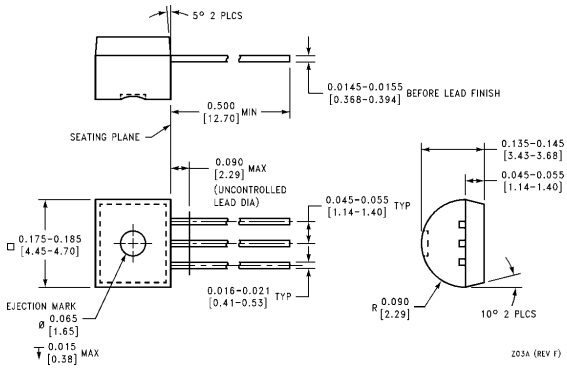
Physical Dimensions inches (millimeters)



S.O. Package (M)
Order Number LM79L05ACM, LM79L12ACM or LM79L15ACM
NS Package Number M08A

Physical Dimensions inches (millimeters) (Continued)



Molded Offset TO-92 (Z)
Order Number LM320LZ-5.0, LM79L05ACZ, LM320LZ-12, LM79L12ACZ, LM320LZ-15 or LM79L15ACZ
NS Package Number Z03A

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National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408