

## LM320L/LM79LXXAC/LM13121 Series 3-Terminal Negative Regulators

### General Description

The LM320L/LM79LXXAC/LM13121 dual marked series of 3-terminal negative voltage regulators features fixed output voltages of  $-5V$ ,  $-12V$ , and  $-15V$  with output current capabilities in excess of 100mA. 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  $0.1\mu F$ , 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/LM13121 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 volt-

ages 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.

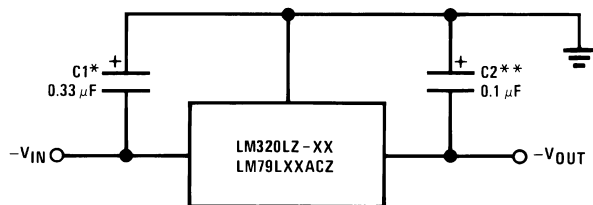
For output voltage other than  $-5V$ ,  $-12V$  and  $-15V$ , the LM137L series provides an output voltage range from 1.2V to 47V.

### Features

- Preset output voltage error is less than  $\pm 5\%$  overload, line and temperature
- Specified at an output current of 100mA
- Easily compensated with a small  $0.1\mu F$  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

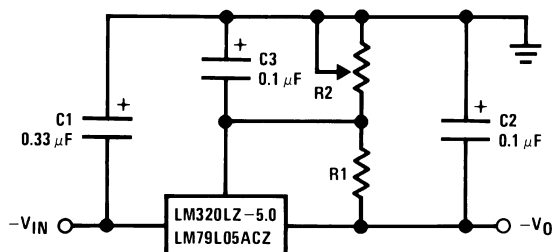


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\*Required if the regulator is located far from the power supply filter. A  $1\mu F$  aluminum electrolytic may be substituted.

\*\*Required for stability. A  $1\mu F$  aluminum electrolytic may be substituted.

#### Adjustable Output Regulator



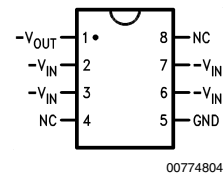
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$$-V_0 = -5V - (5V/R1 + I_Q) \cdot R2,$$

$$5V/R1 > 3 I_Q$$

### Connection Diagrams

#### SO-8 Plastic (Narrow Body)

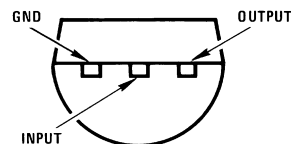


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#### Top View

Order Number LM79L05ACM, LM79L12ACM  
LM79L15ACM, LM79L05ACMX,  
LM79L12ACMX or LM79L15ACMX  
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, LM13121Z-12, LM13121Z-15,  
LM13121Z-5.0  
See NS Package Number Z03A

**Absolute Maximum Ratings** (Note 1)

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 2)

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 3)
 $T_A = 0^\circ\text{C to } +70^\circ\text{C unless otherwise noted.}$ 

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 <sub>O</sub>	Output Voltage	T <sub>J</sub> = 25°C, I <sub>O</sub> = 100mA	-5.2	-5	-4.8	-12.5	-12	-11.5	-15.6	-15	-14.4	V
		1mA ≤ I <sub>O</sub> ≤ 100mA	-5.25		-4.75	-12.6		-11.4	-15.75		-14.25	
		V <sub>MIN</sub> ≤ V <sub>IN</sub> ≤ V <sub>MAX</sub>	(-20 ≤ V <sub>IN</sub> ≤ -7.5)			(-27 ≤ V <sub>IN</sub> ≤ -14.8)			(-30 ≤ V <sub>IN</sub> ≤ -18)			
		1mA ≤ I <sub>O</sub> ≤ 40mA	-5.25		-4.75	-12.6		-11.4	-15.75		-14.25	
		V <sub>MIN</sub> ≤ V <sub>IN</sub> ≤ V <sub>MAX</sub>	(-20 ≤ V <sub>IN</sub> ≤ -7)			(-27 ≤ V <sub>IN</sub> ≤ -14.5)			(-30 ≤ V <sub>IN</sub> ≤ -17.5)			
ΔV <sub>O</sub>	Line Regulation	T <sub>J</sub> = 25°C, I <sub>O</sub> = 100mA	60			45			45			mV
		V <sub>MIN</sub> ≤ V <sub>IN</sub> ≤ V <sub>MAX</sub>	(-20 ≤ V <sub>IN</sub> ≤ -7.3)			(-27 ≤ V <sub>IN</sub> ≤ -14.6)			(-30 ≤ V <sub>IN</sub> ≤ -17.7)			V
		T <sub>J</sub> = 25°C, I <sub>O</sub> = 40mA	60			45			45			mV
		V <sub>MIN</sub> ≤ V <sub>IN</sub> ≤ V <sub>MAX</sub>	(-20 ≤ V <sub>IN</sub> ≤ -7)			(-27 ≤ V <sub>IN</sub> ≤ -14.5)			(-30 ≤ V <sub>IN</sub> ≤ -17.5)			V
ΔV <sub>O</sub>	Load Regulation	T <sub>J</sub> = 25°C										mV
		1mA ≤ I <sub>O</sub> ≤ 100mA	50			100			125			
ΔV <sub>O</sub>	Long Term Stability	I <sub>O</sub> = 100mA	20			48			60			mV/khrs
I <sub>Q</sub>	Quiescent Current	I <sub>O</sub> = 100mA	2      6			2      6			2      6			mA
ΔI <sub>Q</sub>	Quiescent Current Change	1mA ≤ I <sub>O</sub> ≤ 100mA	0.3			0.3			0.3			
		1mA ≤ I <sub>O</sub> ≤ 40mA	0.1			0.1			0.1			
		I <sub>O</sub> = 100mA	0.25			0.25			0.25			mA
		V <sub>MIN</sub> ≤ V <sub>IN</sub> ≤ V <sub>MAX</sub>	(-20 ≤ V <sub>IN</sub> ≤ -7.5)			(-27 ≤ V <sub>IN</sub> ≤ -14.8)			(-30 ≤ V <sub>IN</sub> ≤ -18)			V
V <sub>n</sub>	Output Noise Voltage	T <sub>J</sub> = 25°C, I <sub>O</sub> = 100mA	40			96			120			μV
		f = 10Hz – 10kHz										
$\frac{\Delta V_{IN}}{\Delta V_O}$	Ripple Rejection	T <sub>J</sub> = 25°C, I <sub>O</sub> = 100mA f = 120Hz	50			52			50			dB
	Input Voltage Required to Maintain Line Regulation	T <sub>J</sub> = 25°C, I <sub>O</sub> = 100mA	-7.3			-14.6			-17.7			V
		I <sub>O</sub> = 40mA	-7.0			-14.5			-17.5			V

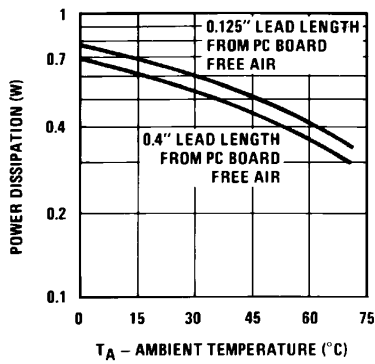
**Note 1:** Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits.

**Note 2:** Thermal resistance of Z package is 60°C/W  $\theta_{JC}$ , 232°C/W  $\theta_{JA}$  at still air, and 88°C/W at 400 ft/min of air. The M package  $\theta_{JA}$  is 180°C/W in still air. The maximum junction temperature shall not exceed 125°C on electrical parameters.

**Note 3:** To ensure constant junction temperature, low duty cycle pulse testing is used.

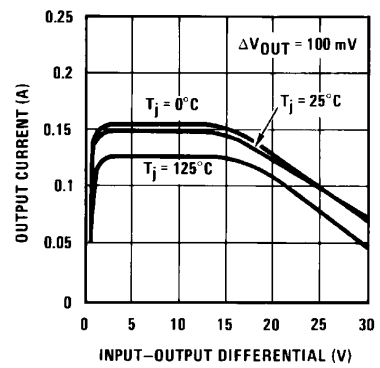
# Typical Performance Characteristics

Maximum Average Power  
Dissipation (TO-92)



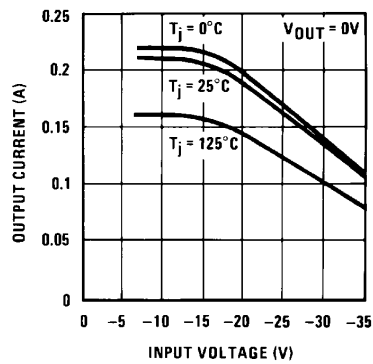
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Peak Output Current



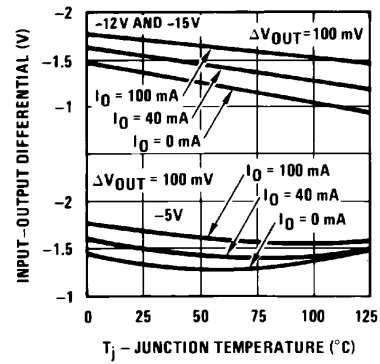
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Short Circuit Output  
Current



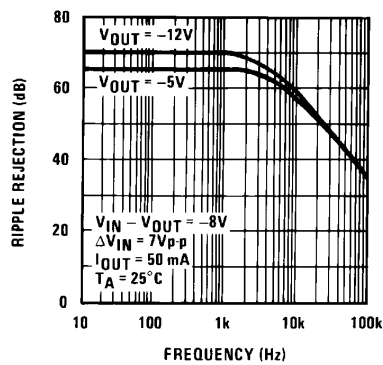
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Dropout Voltage



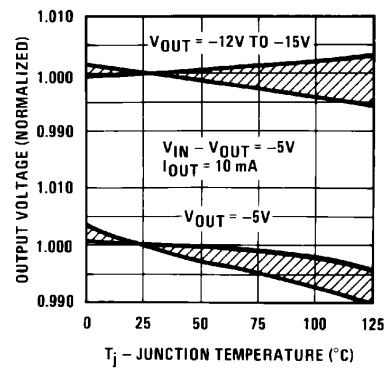
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Ripple Rejection



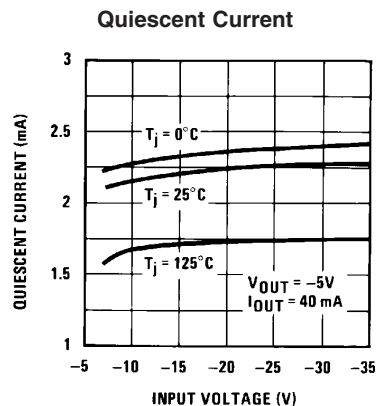
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Output Voltage vs.  
Temperature (Normalized  
to 1V @  $25^{\circ}\text{C}$ )

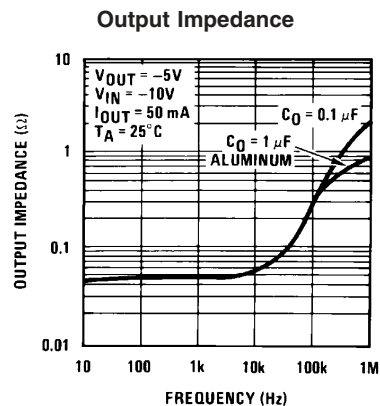


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## Typical Performance Characteristics (Continued)



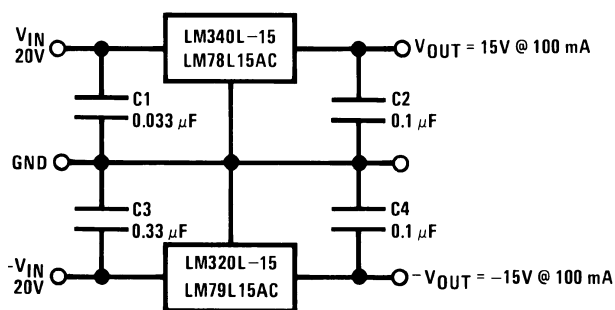
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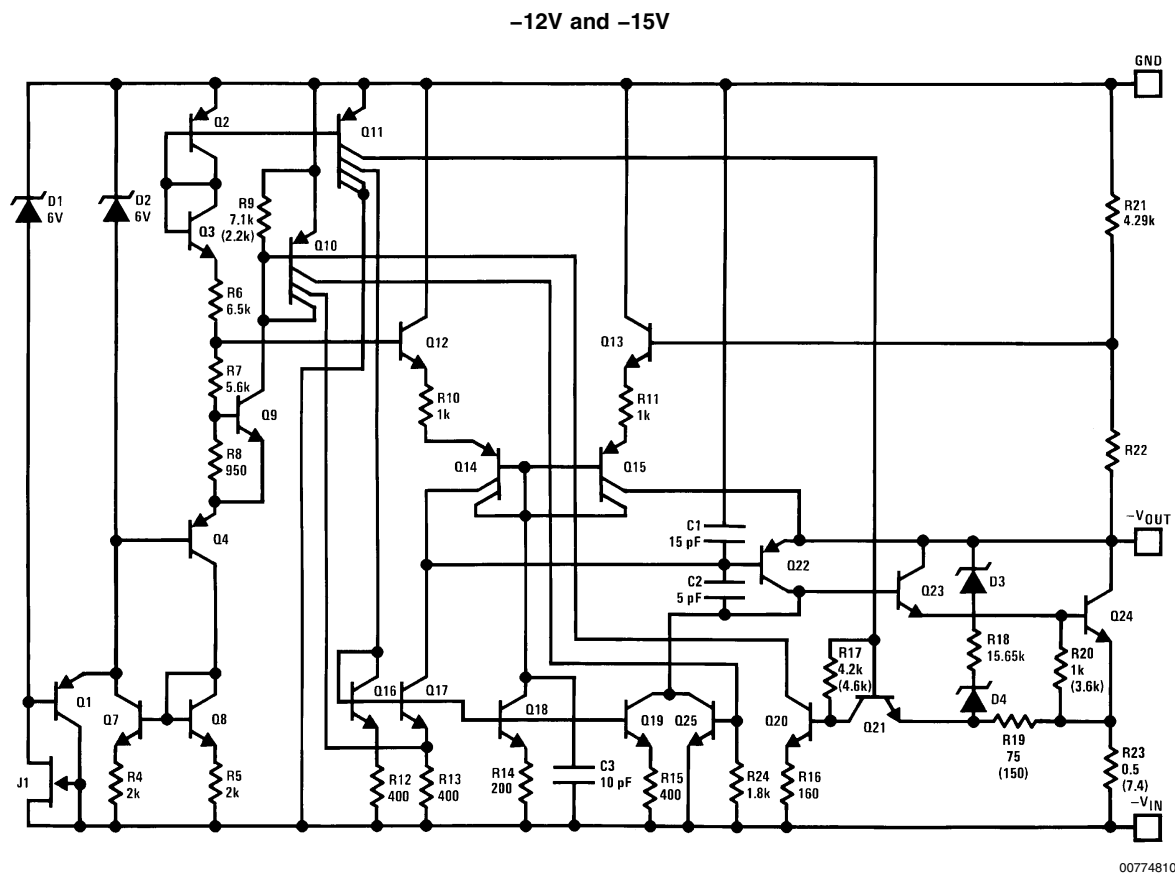
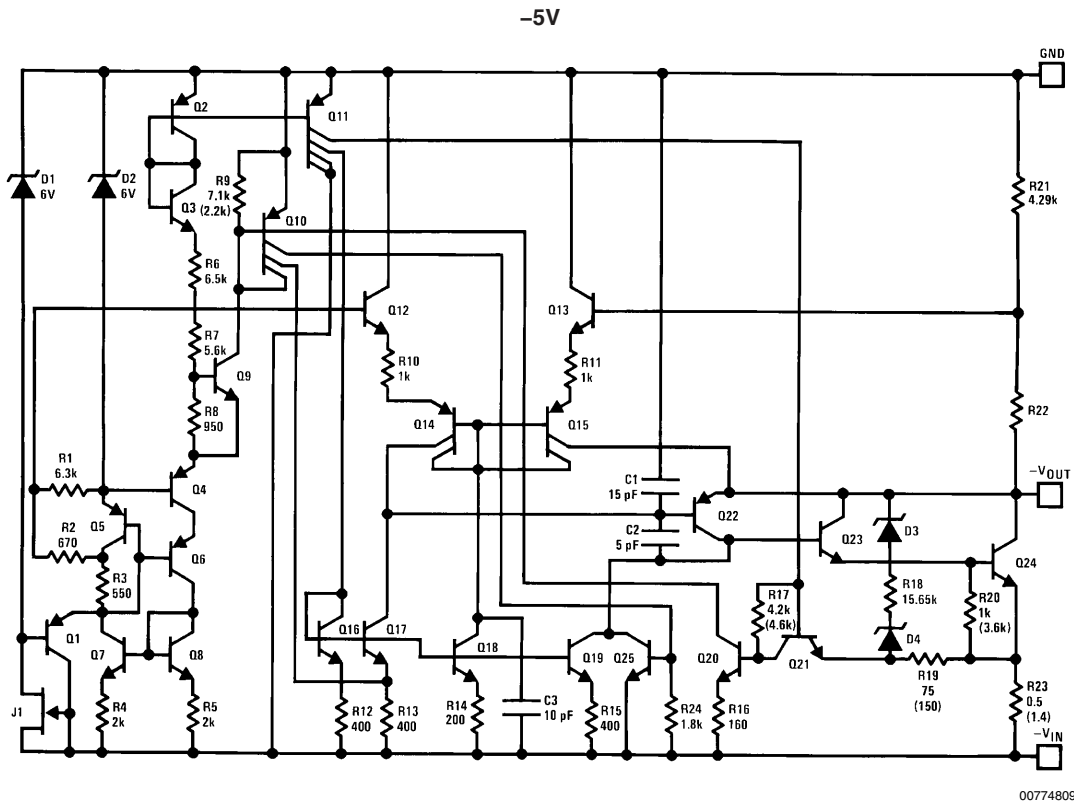
## Typical Applications

**$\pm 15\text{V}$ , 100mA Dual Power Supply**



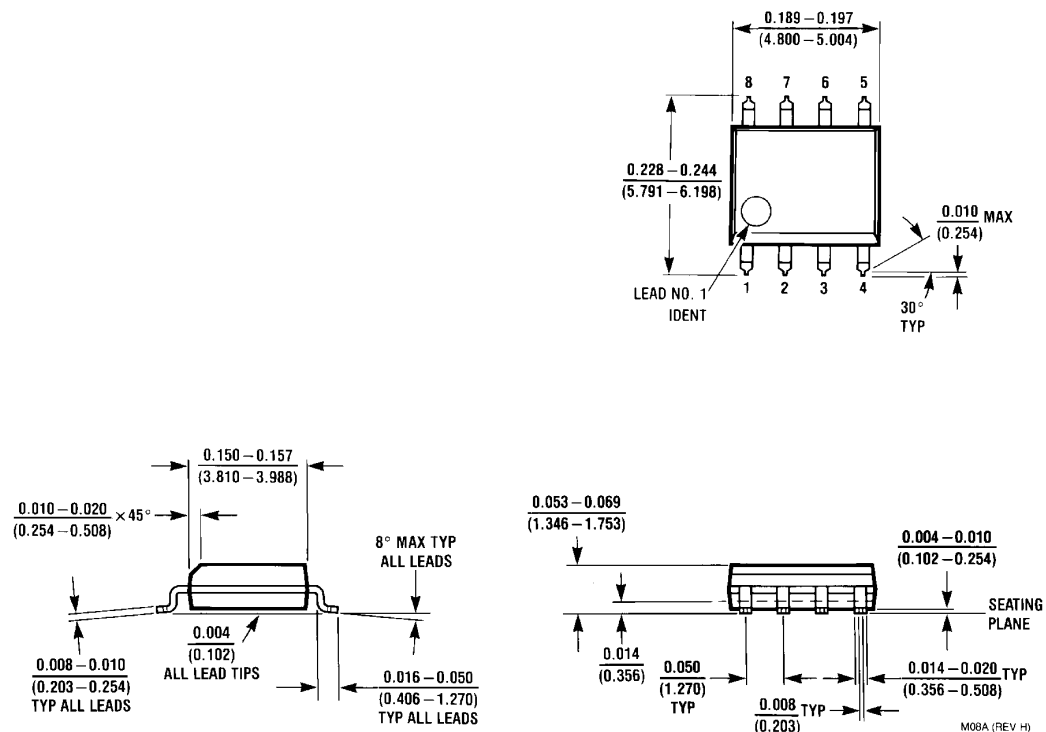
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## Schematic Diagrams

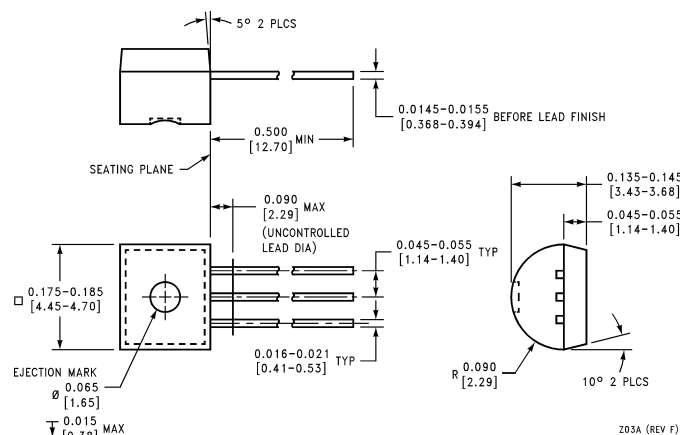


**Physical Dimensions** inches (millimeters)

unless otherwise noted

**S.O. Package (M)**Order Number LM79L05ACM, LM79L12ACM, LM79L15ACM,  
LM79L05ACMX, LM79L12ACMX, or LM79L15ACMX

NS Package Number M08A

**Molded Offset TO-92 (Z)**Order Number LM320LZ-5.0, LM79L05ACZ, LM320LZ-12,  
LM79L12ACZ, LM320LZ-15 or LM79L15ACZ, LM13121Z-12,  
LM13121Z-15, LM13121Z-5.0

NS Package Number Z03A

## Notes

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