

## LM140L/LM340L Series 3-Terminal Positive Regulators

### General Description

The LM140L series of three terminal positive regulators is available with several fixed output voltages making them useful in a wide range of applications. The LM140LA is an improved version of the LM78LXX series with a tighter output voltage tolerance (specified over the full military temperature range), higher ripple rejection, better regulation and lower quiescent current. The LM140LA regulators have  $\pm 2\%$   $V_{OUT}$  specification, 0.04%/V line regulation, and 0.01%/mA load regulation. When used as a zener diode/resistor combination replacement, the LM140LA usually results in an effective output impedance improvement of two orders of magnitude, and lower quiescent current. These regulators can provide local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow the LM140LA to be used in logic systems, instrumentation, Hi-Fi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

The LM140LA/LM340LA are available in the low profile metal three lead TO-39 (H) and the LM340LA are also available in the plastic TO-92 (Z). With adequate heat sinking the regulator can deliver 100 mA output current. Current limiting is included to limit the peak output current to a safe value. Safe area protection for the output transistor is provided to limit internal power dissipation. If internal power dissipation

becomes too high for the heat sinking provided, the thermal shut-down circuit takes over, preventing the IC from overheating.

For applications requiring other voltages, see LM117L Data Sheet.

### Features

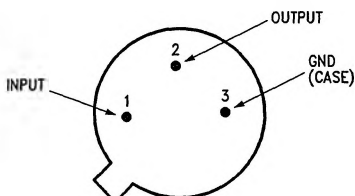
- Line regulation of 0.04%/V
- Load regulation of 0.01%/mA
- Output voltage tolerances of  $\pm 2\%$  at  $T_j = 25^\circ\text{C}$  and  $\pm 4\%$  over the temperature range (LM140LA)  $\pm 3\%$  over the temperature range (LM340LA)
- Output current of 100 mA
- Internal thermal overload protection
- Output transistor safe area protection
- Internal short circuit current limit
- Available in metal TO-39 low profile package (LM140LA/LM340LA) and plastic TO-92 (LM340LA)

### Output Voltage Options

LM140LA-5.0	5V	LM340LA-5.0	5V
LM140LA-12	12V	LM340LA-12	12V
LM140LA-15	15V	LM340LA-15	15V

### Connection Diagrams

**TO-39 Metal Can Package (H)**

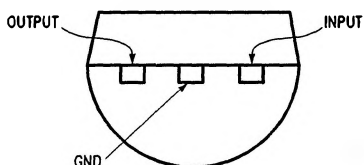


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**Bottom View**

**Order Number LM140LAH-5.0, LM140LAH-12, LM140LAH-15,  
LM340LAH-5.0, LM340LAH-12 or LM340LAH-15  
See NS Package Number H03A**

**TO-92 Plastic Package (Z)**



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**Bottom View**

**Order Number LM340LAZ-5.0, LM340LAZ-12 or LM340LAZ-15  
See NS Package Number Z03A**

## Absolute Maximum Ratings

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

(Note 5)

Input Voltage

5.0V, 12V, 15V Output Voltage Options 35V

Internal Power Dissipation (Note 1) Internally Limited

Operating Temperature Range

LM140LA

–55°C to +125°C

LM340LA

0°C to +70°C

Maximum Junction Temperature

+150°C

Storage Temperature Range

Metal Can (H package)

–65°C to +150°C

Molded TO-92

–55°C to +150°C

Lead Temperature (Soldering, 10 sec.)

+300°C

Plastic TO-92

+230°C

## Electrical Characteristics (Note 2)

Test conditions unless otherwise specified.  $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$  (LM140LA),  $T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$  (LM340LA),  $I_O = 40\text{ mA}$ ,  $C_{IN} = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.01\text{ }\mu\text{F}$ .

Output Voltage Option				5.0V			12V			15V			Units
Input Voltage (unless otherwise noted)				10V			19V			23V			
Symbol	Parameter	Conditions		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V <sub>O</sub>	Output Voltage	T <sub>j</sub> = 25°C		4.9	5	5.1	11.75	12	12.25	14.7	15	15.3	V
	Output Voltage Over Temp. (Note 4)	LM140LA	I <sub>O</sub> = 1 – 100 mA	4.8		5.2	11.5		12.5	14.4		15.6	
				(7.2–20)		(14.5–27)		(17.6–30)					
		LM340LA	I <sub>O</sub> = 1 – 100 mA or I <sub>O</sub> = 1 – 40 mA and V <sub>IN</sub> = ( )V	4.85		5.15	11.65		12.35	14.55		15.45	
				(7–20)		(14.3–27)		(17.5–30)					
ΔV <sub>O</sub>	Line Regulation	T <sub>j</sub> = 25°C	I <sub>O</sub> = 40 mA V <sub>IN</sub> = ( )V	18 30		30 65		37 70		mV			
				(7–25)		(14.2–30)		(17.3–30)					
			I <sub>O</sub> = 100 mA V <sub>IN</sub> = ( )V	18 30		30 65		37 70					
				(7.5–25)		(14.5–30)		(17.5–30)					
	Load Regulation	T <sub>j</sub> = 25°C	I <sub>O</sub> = 1 – 40 mA I <sub>O</sub> = 1 – 100 mA	5 20		10 40		12 50					
				20 40		30 80		35 100					
	Long Term Stability			12		24		30		mV 1000 hrs			
I <sub>O</sub>	Quiescent Current	T <sub>j</sub> = 25°C		3	4.5	3 4.5		3.1 4.5		mA			
		T <sub>j</sub> = 125°C		4.2		4.2		4.2					
ΔI <sub>O</sub>	Quiescent Current Change	T <sub>j</sub> = 25°C	ΔLoad I <sub>O</sub> = 1 – 40 mA	0.1		0.1		0.1		mA			
			ΔLine	0.5		0.5		0.5					
			V <sub>IN</sub> = ( )V	(7.5–25)		(14.3–30)		(17.5–30)					
V <sub>N</sub>	Output Noise Voltage	T <sub>j</sub> = 25°C (Note 3) f = 10 Hz–10 kHz		40		80		90		μV			
$\frac{\Delta V_{IN}}{\Delta V_{OUT}}$	Ripple Rejection	f = 120 Hz, V <sub>IN</sub> = ( )V		55	62	47 54		45 52		dB			
				(7.5–18)		(14.5–25)		(17.5–28.5)					
	Input Voltage Required to Maintain Line Regulation	T <sub>j</sub> = 25°C, I <sub>O</sub> = 40 mA		7		14.2		17.3		V			

**Note 1:** Thermal resistance of H-package is typically  $26^\circ\text{C/W}$   $\theta_{JC}$ ,  $250^\circ\text{C/W}$   $\theta_{JA}$  still air, and  $94^\circ\text{C/W}$   $\theta_{JA}$  400 l/min of air. For the Z-package is  $60^\circ\text{C/W}$   $\theta_{JC}$ ,  $232^\circ\text{C/W}$   $\theta_{JA}$  still air, and  $88^\circ\text{C/W}$   $\theta_{JA}$  at 400 l/min of air. The maximum junction temperature shall not exceed  $125^\circ\text{C}$  on electrical parameters.

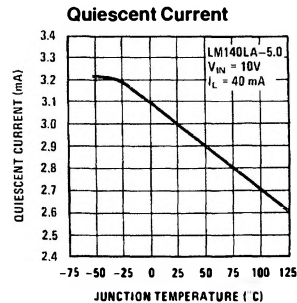
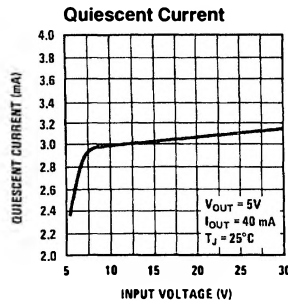
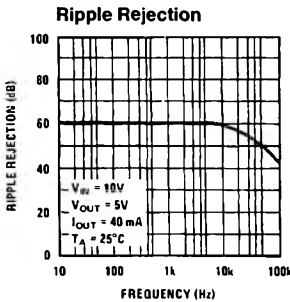
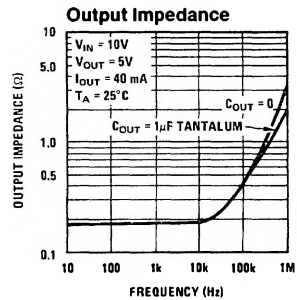
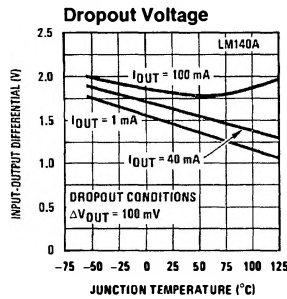
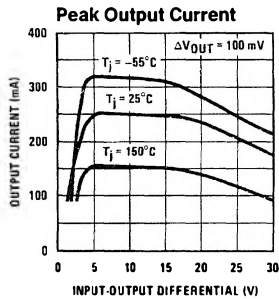
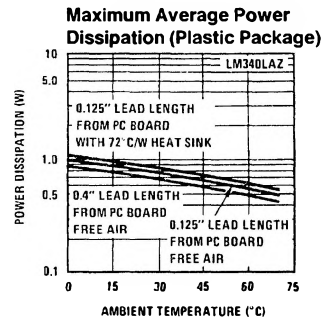
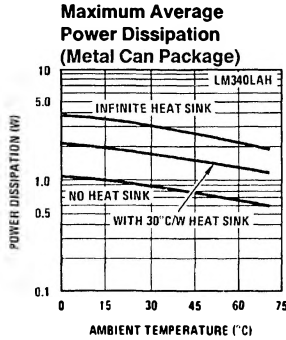
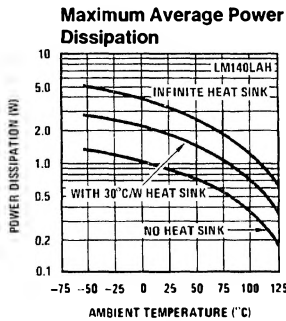
**Note 2:** The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of tests.

**Note 3:** It is recommended that a minimum load capacitor of  $0.01\text{ }\mu\text{F}$  be used to limit the high frequency noise bandwidth.

**Note 4:** The temperature coefficient of  $V_{OUT}$  is typically within  $0.01\%$   $V_O/^\circ\text{C}$ .

**Note 5:** Refer to RETS140-12H for LM140LAH-12, RETS140-15H for LM140LAH-15 or RETS140-15H for LM140LAH-5.0 military specification.

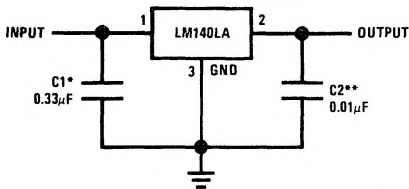
## Typical Performance Characteristics



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## Typical Applications

### Fixed Output Regulator

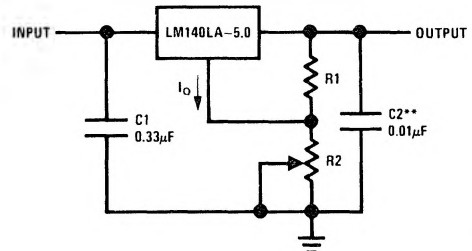


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\*Required if the regulator is located far from the power supply filter.

\*\*See note 3 in the electrical characteristics table.

### Adjustable Output Regulator

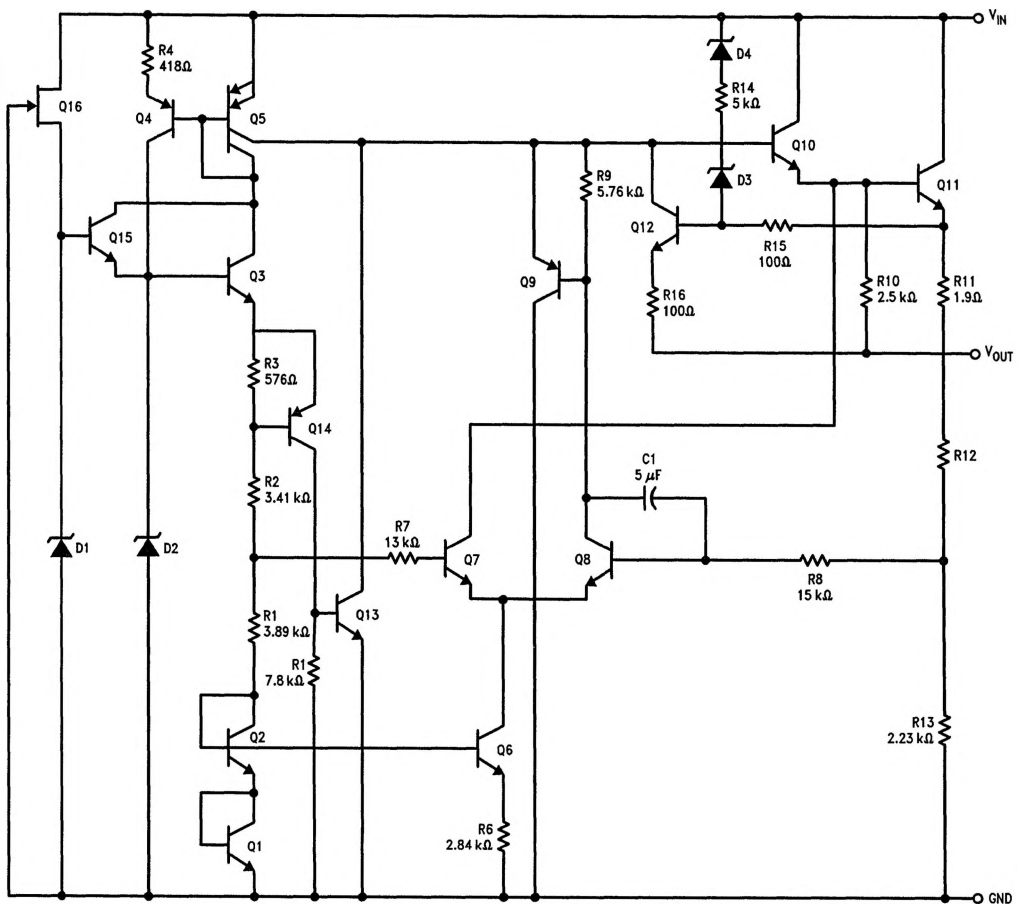


$$V_{OUT} = 5V + (5V/R1 + I_O) R2$$

$$5V/R1 = 3 I_O \text{ load regulation (L)} [(R1 + R2)/R1] \text{ (L, of LM140LA-5.0)}$$

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## Equivalent Circuit



TL/H/7782-1