

LM140LQML 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.

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 dissipa-

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

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
- Output current of 100 mA
- Internal thermal overload protection
- Output transistor safe area protection
- Internal short circuit current limit

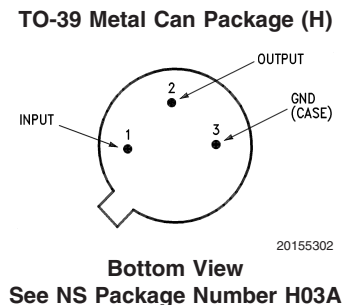
Output Voltage Options

Device ID	Output Voltage
LM140LA-5.0	5V
LM140LA-12	12V
LM140LA-15	15V

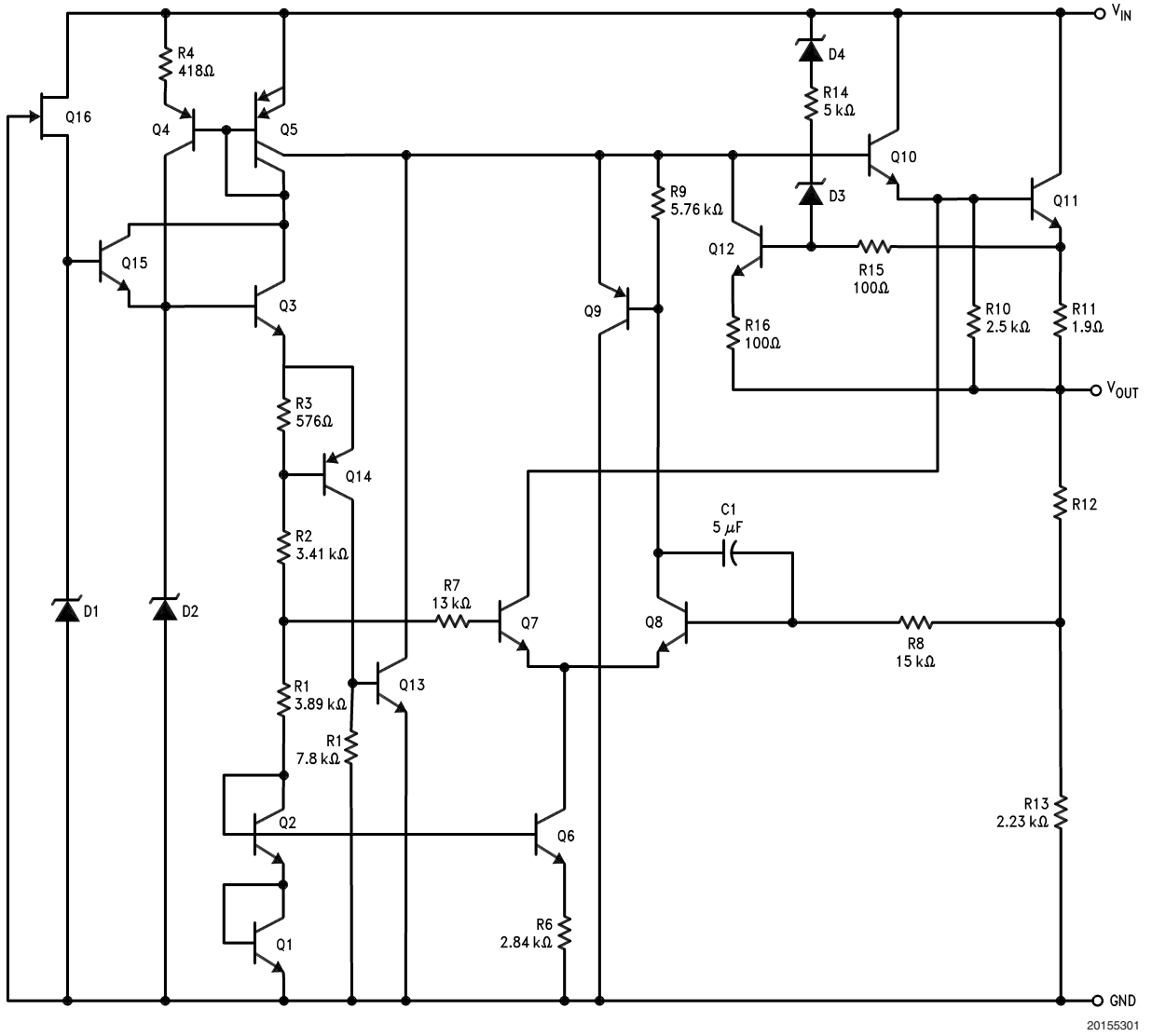
Ordering Information

NS Part Number	JAN Part Number	NS Package Number	Package Description
LM140LAH-5.0/883		H03A	3LD TO-39 Metal Can
LM140LAH-12/883		H03A	3LD TO-39 Metal Can
LM140LAH-15/883		H03A	3LD TO-39 Metal Can

Connection Diagrams



Equivalent Circuit



Absolute Maximum Ratings (Note 1)

Input Voltage	35V
Internal Power Dissipation (Note 2)	Internally Limited
Operating Temperature Range	$-55^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$
Maximum Junction Temperature	$+150^{\circ}\text{C}$
Storage Temperature Range	$-65^{\circ}\text{C} \leq T_A \leq +150^{\circ}\text{C}$
Lead Temperature (Soldering, 10 sec.)	$+300^{\circ}\text{C}$
Thermal Resistance	
θ_{JA}	
Still Air @ 0.5W	201°C/W
500LF / Min Air Flow @ 0.5W	79°C/W
θ_{JC} (@ 1.0W)	38°C/W
ESD Susceptibility (Note 3)	TBD

Quality Conformance Inspection

Mil-Std-883, Method 5005 - Group A

Subgroup	Description	Temp °C
1	Static tests at	25
2	Static tests at	125
3	Static tests at	-55
4	Dynamic tests at	25
5	Dynamic tests at	125
6	Dynamic tests at	-55
7	Functional tests at	25
8A	Functional tests at	125
8B	Functional tests at	-55
9	Switching tests at	25
10	Switching tests at	125
11	Switching tests at	-55
12	Settling time at	25
13	Settling time at	125
14	Settling time at	-55

LM140LA-5.0 Electrical Characteristics

DC Parameters

The following conditions apply, unless otherwise specified.

DC: $V_I = 10V$, $I_L = 40mA$

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups	
I_Q	Quiescent Current				4.5	mA	1	
					4.2	mA	2	
V_O	Output Voltage			4.9	5.1	V	1	
				$V_I = 20V$, $I_L = 5mA$	4.8	5.2	V	1, 2, 3
				$V_I = 20V$, $I_L = 100mA$	4.8	5.2	V	1, 2, 3
				$V_I = 7.2V$, $I_L = 5mA$	4.8	5.2	V	1, 2, 3
				$V_I = 7.2V$, $I_L = 100mA$	4.8	5.2	V	1, 2, 3
R_{Load}	Load Regulation	$5mA \leq I_L \leq 40mA$		-20	20	mV	1	
				$5mA \leq I_L \leq 100mA$	-40	40	mV	1
R_{Line}	Line Regulation	$I_L = 100mA$, $7.5V \leq V_I \leq 25V$		-30	30	mV	1	
				$7V \leq V_I \leq 25V$	-30	30	mV	1
ΔI_Q	Quiescent Current Change	$5mA \leq I_L \leq 40mA$		-0.1	0.1	mA	1, 2, 3	
				$7.5V \leq V_I \leq 35V$	-0.5	0.5	mA	1

AC Parameters

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
RR	Ripple Rejection	$f = 120Hz$, $e_1 = 1V_{RMS}$		55		dB	4

LM140LA-12 Electrical Characteristics

DC Parameters

The following conditions apply, unless otherwise specified.

DC: $V_I = 19V$, $I_L = 40mA$

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups	
I_Q	Quiescent Current				4.5	mA	1	
					4.2	mA	2	
V_O	Output Voltage			11.75	12.25	V	1	
				$V_I = 27V$, $I_L = 5mA$	11.5	12.5	V	1, 2, 3
				$V_I = 27V$, $I_L = 100mA$	11.5	12.5	V	1, 2, 3
				$V_I = 14.5V$, $I_L = 5mA$	11.5	12.5	V	1, 2, 3
				$V_I = 14.5V$, $I_L = 100mA$	11.5	12.5	V	1, 2, 3
R_{Load}	Load Regulation	$5mA \leq I_L \leq 40mA$		-40	40	mV	1	
				$5mA \leq I_L \leq 100mA$	-80	80	mV	1
R_{Line}	Line Regulation	$I_L = 100mA$, $14.5V \leq V_I \leq 30V$		-65	65	mV	1	
				$14.2V \leq V_I \leq 30V$	-65	65	mV	1
ΔI_Q	Quiescent Current Change	$5mA \leq I_L \leq 40mA$		-0.1	0.1	mA	1, 2, 3	
				$14.3V \leq V_I \leq 35V$	-0.5	0.5	mA	1

AC Parameters

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
RR	Ripple Rejection	$f = 120Hz$, $e_1 = 1V_{RMS}$		47		dB	4

LM140LA-15 Electrical Characteristics

DC Parameters

The following conditions apply, unless otherwise specified.

DC: $V_I = 23V$, $I_L = 40mA$

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
I_Q	Quiescent Current				4.5	mA	1
					4.2	mA	2
V_O	Output Voltage			14.7	15.3	V	1
		$V_I = 30V$, $I_L = 5mA$		14.4	15.6	V	1, 2, 3
		$V_I = 30V$, $I_L = 100mA$		14.4	15.6	V	1, 2, 3
		$V_I = 17.6V$, $I_L = 5mA$		14.4	15.6	V	1, 2, 3
		$V_I = 17.6V$, $I_L = 100mA$		14.4	15.6	V	1, 2, 3
R_{Load}	Load Regulation	$5mA \leq I_L \leq 40mA$		-50	50	mV	1
		$5mA \leq I_L \leq 100mA$		-100	100	mV	1
R_{Line}	Line Regulation	$I_L = 100mA$, $17.3V \leq V_I \leq 30V$		-70	70	mV	1
		$17.3V \leq V_I \leq 30V$		-70	70	mV	1
ΔI_Q	Quiescent Current Change	$5mA \leq I_L \leq 40mA$		-0.1	0.1	mA	1, 2, 3
		$17.5V \leq V_I \leq 35V$		-0.5	0.5	mA	1

AC Parameters

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
RR	Ripple Rejection f	$f = 120Hz$, $e_i = 1V_{RMS}$		47		dB	4

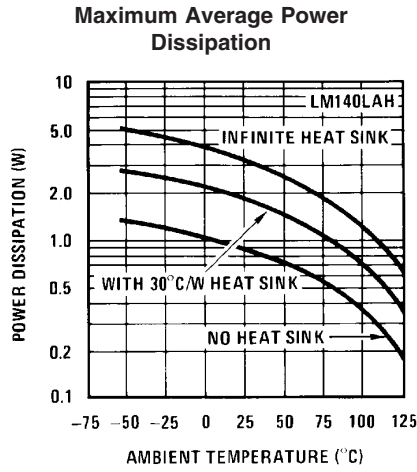
Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

Note 2: The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{Jmax} (maximum junction temperature), θ_{JA} (package junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is $P_{Dmax} = (T_{Jmax} - T_A)/\theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower.

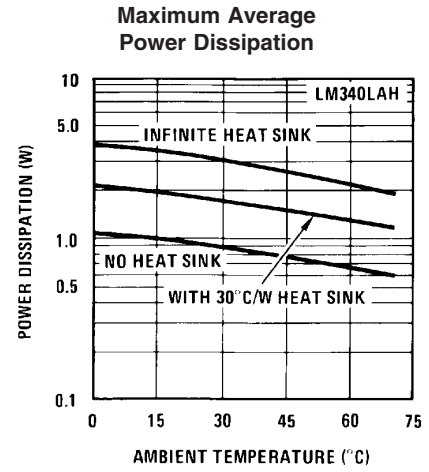
Note 3: Human body model, 100pF discharged through 1.5K Ω

Note 4: It is recommended that a minimum load capacitor of 0.01 μF be used to limit the high frequency noise bandwidth.

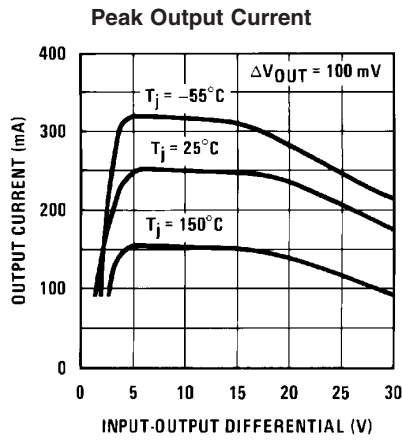
Typical Performance Characteristics



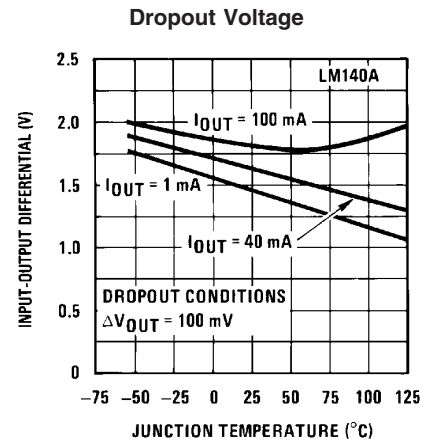
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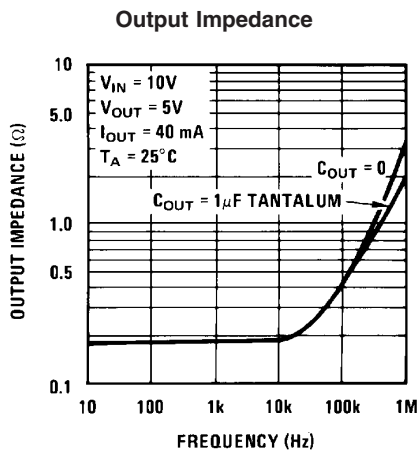
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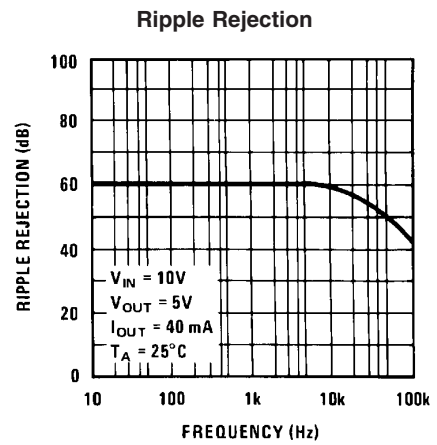
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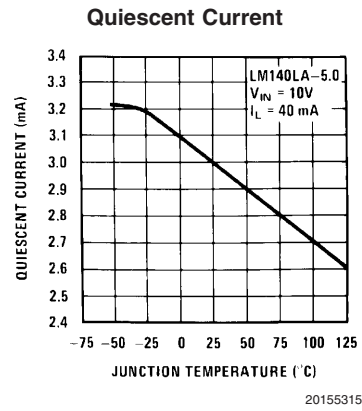
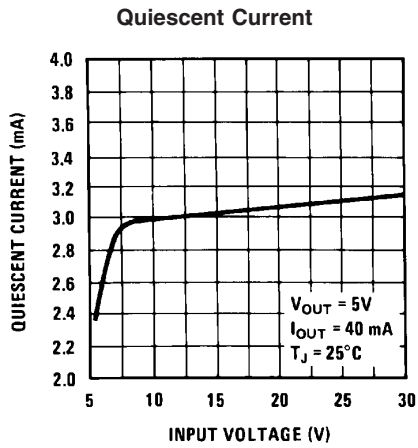


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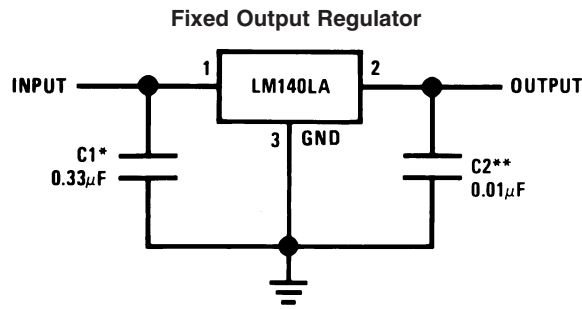


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Typical Performance Characteristics (Continued)

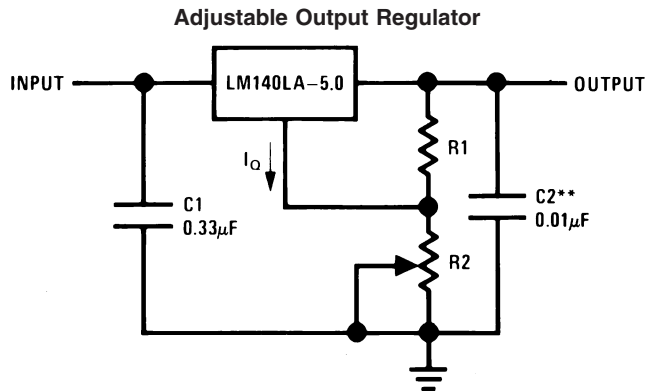


Typical Applications (Note 4)



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

**See note 3 in the electrical characteristics table.



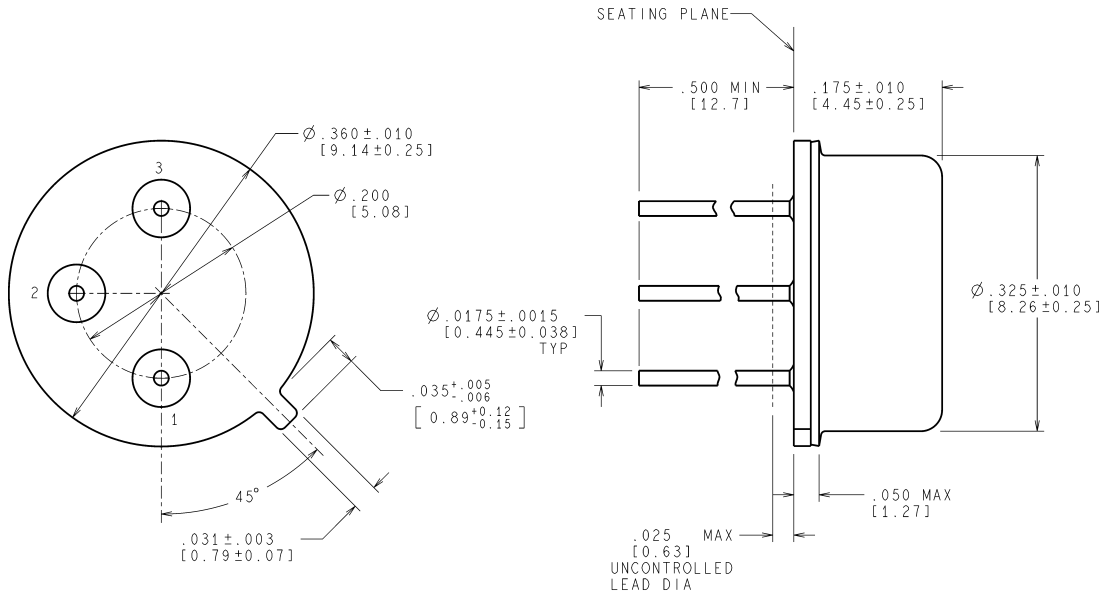
$$V_{OUT} = 5V + (5V/R1 + I_O) R2$$

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

Revision History

Released	Revision	Section	Originator	Changes
03/10/06	A	New release to corporate format	L. Lytle	3 MDS data sheets converted into one Corp. data sheet format. Drift tables were removed from electrical characteristics since not performed on 883 product. MDS data sheets MNLM140LA-05-H Rev. 0B0, MNLM140LA-12-H Rev. 0B0 and MNLM140LA-15-H Rev. 0B0. will be archived.

Physical Dimensions inches (millimeters) unless otherwise noted



CONTROLLING DIMENSION IS INCH
VALUES IN [] ARE MILLIMETERS

MIL-PRF-38535
CONFIGURATION CONTROL

H03A (Rev D)

**TO-39 Metal Can Package (H)
NS Package Number H03A**

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