National Semiconductor

May 1998

LM330 3-Terminal Positive Regulator

General Description

The LM330 5V 3-terminal positive voltage regulator features an ability to source 150 mA of output current with an input-output differential of 0.6V or less. Familiar regulator features such as current limit and thermal overload protection are also provided.

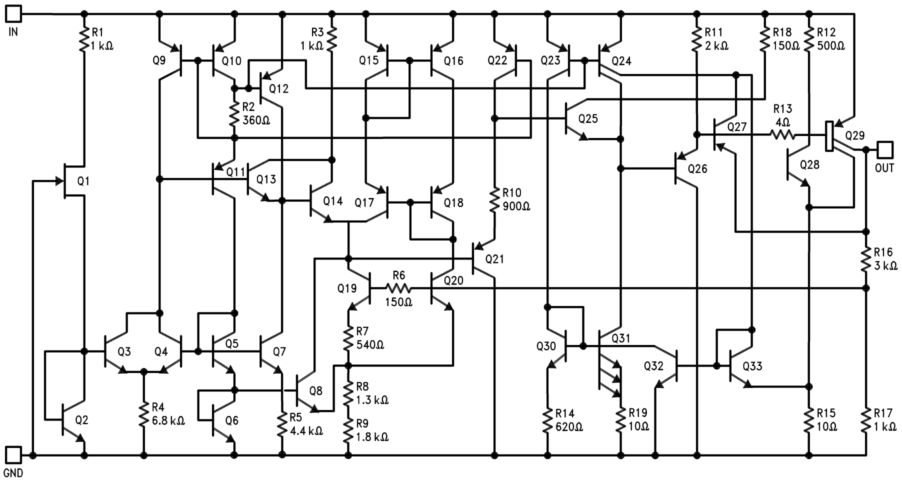
The low dropout voltage makes the LM330 useful for certain battery applications since this feature allows a longer battery discharge before the output falls out of regulation. For example, a battery supplying the regulator input voltage may discharge to 5.6V and still properly regulate the system and load voltage. Supporting this feature, the LM330 protects both itself and regulated systems from negative voltage inputs resulting from reverse installations of batteries.

Other protection features include line transient protection up to 26V, when the output actually shuts down to avoid damaging internal and external circuits. Also, the LM330 regulator cannot be harmed by a temporary mirror-image insertion.

Features

- Input-output differential less than 0.6V
- Output current of 150 mA
- Reverse battery protection
- Line transient protection
- Internal short circuit current limit
- Internal thermal overload protection
- Mirror-image insertion protection
- P^+ Product Enhancement tested

Schematic and Connection Diagrams



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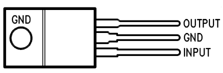
(TO-220)
Plastic Package



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Front View
Order Number LM330T-5.0
See NS Package Number T03B

 DS009306

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	
Operating Range	26V
Line Transient Protection (1000 ms)	40V
Internal Power Dissipation	Internally Limited
Operating Temperature Range	0˚C to +70˚C
Maximum Junction Temperature	+125˚C
Storage Temperature Range	−65˚C to +150˚C
Lead Temperature	
(Soldering, 10 sec.)	+300˚C

Electrical Characteristics (Note 2)

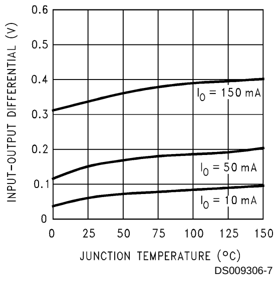
Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_o	Output Voltage	T_j = 25˚C	4.8	5	5.2	V
	Output Voltage Over Temp	5 < I_o < 150 mA 6 < V_{IN} < 26V; 0˚C ≤ T_j ≤ 100˚C	4.75		5.25	
ΔV_o	Line Regulation	9 < V_{IN} < 16V, I_o = 5 mA		7	25	mV
		6 < V_{IN} < 26V, I_o = 5 mA		30	60	
	Load Regulation	5 < I_o < 150 mA		14	50	
	Long Term Stability			20		mV/1000 hrs
I_Q	Quiescent Current	I_o = 10 mA		3.5	7	mA
		I_o = 50 mA		5	11	
		I_o = 150 mA		18	40	
	Line Transient	V_{IN} = 40V, R_L = 100Ω, 1s		14		
	Reverse Polarity	V_{IN} = −6V, R_L = 100Ω		−80		
ΔI_Q	Quiescent Current Change	6 < V_{IN} < 26V		10		%
V_{IN}	Overvoltage Shutdown Voltage		26	38		V
	Max Line Transient			60		
		1s, V_o ≤ 5.5V		50		
	Reverse Polarity Input Voltage			−30		
		DC V_o > − 0.3V, R_L = 100Ω		−12		
	Output Noise Voltage	10 Hz–100 kHz		50		µV
	Output Impedance	I_o = 100 mADC + 10 mArms		200		mΩ
	Ripple Rejection			56		dB
	Current Limit		150	400	700	mA
	Dropout Voltage	I_o = 150 mA		0.32	0.6	V
	Thermal Resistance	Junction to Case		4		˚C/W
		Junction to Ambient		50		

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.

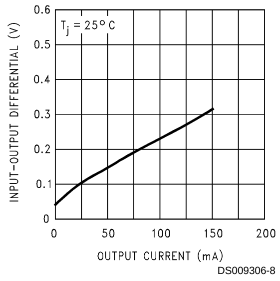
Note 2: Unless otherwise specified: V_{IN} = 14V, I_o = 150 mA, T_j = 25˚C, C1 = 0.1 µF, C2 = 10 µF. All characteristics except noise voltage and ripple rejection are measured using pulse techniques (t_W ≤ 10 ms, duty cycle ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

Typical Performance Characteristics

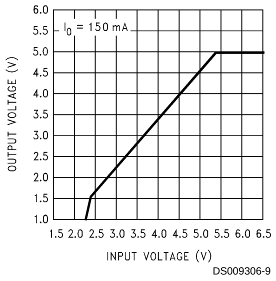
Dropout Voltage



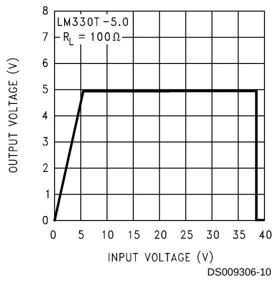
Dropout Voltage



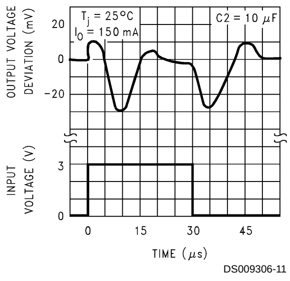
Low Voltage Behavior



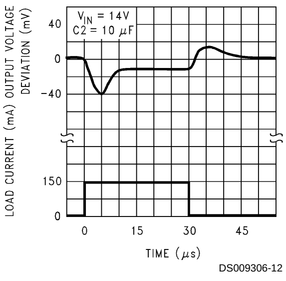
High Voltage Behavior



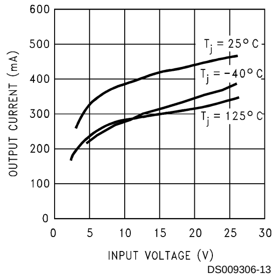
Line Transient Response



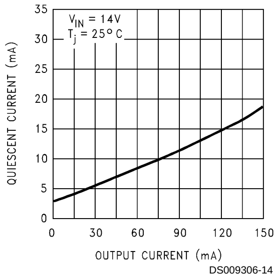
Load Transient Response



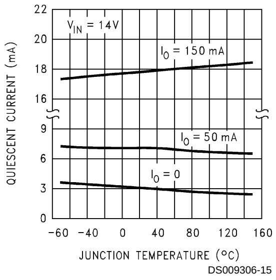
Peak Output Current



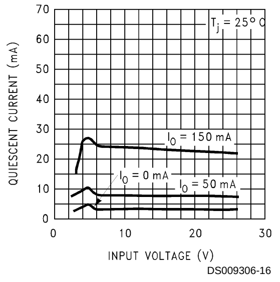
Quiescent Current



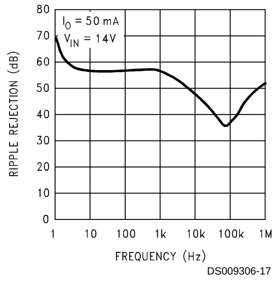
Quiescent Current



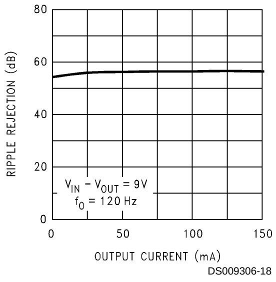
Quiescent Current



Ripple Rejection

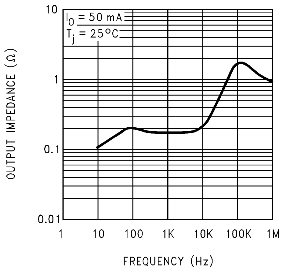


Ripple Rejection



Typical Performance Characteristics (Continued)

Output Impedance



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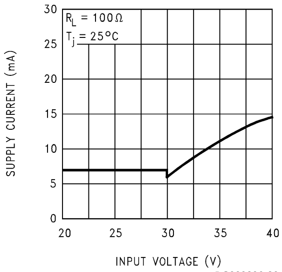
Overvoltage Supply Current



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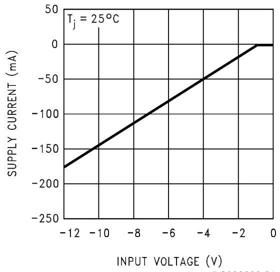
Reverse Supply Current



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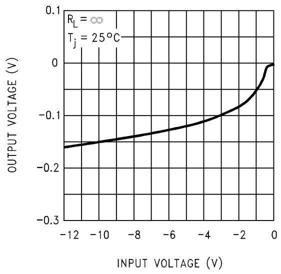
Output at Reverse Supply



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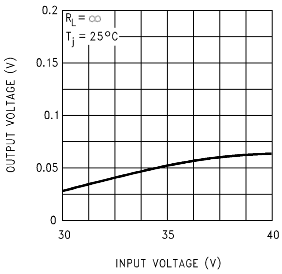
Output at Overvoltage



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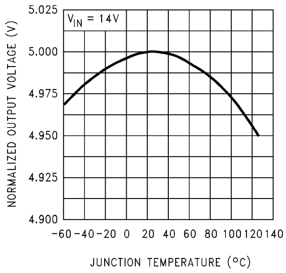
Output Voltage (Normalized to 5V at T_j = 25°C)



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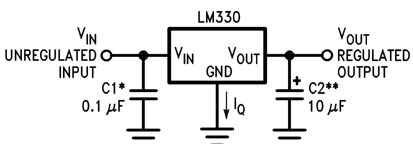
Typical Applications

The LM330 is designed specifically to operate at lower input to output voltages. The device is designed utilizing a power lateral PNP transistor which reduces dropout voltage from 2.0V to 0.3V when compared to IC regulators using NPN pass transistors. Since the LM330 can operate at a much lower input voltage, the device power dissipation is reduced, heat sinking can be simpler and device reliability improved through lower chip operating temperature. Also, a cost savings can be utilized through use of lower power/voltage components. In applications utilizing battery power, the LM330 allows the battery voltage to drop to within 0.3V of output voltage prior to the voltage regulator dropping out of regulation.



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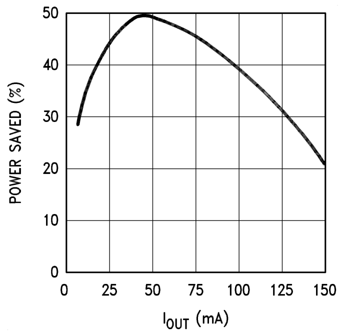
* Required if regulator is located far from power supply filter.

** C2 may be either an Aluminum or Tantalum type capacitor but must be rated to operate at −40˚C to guarantee regulator stability to that temperature extreme. 10 µF is the minimum value required for stability and may be increased without bound. Locate as close as possible to the regulation.



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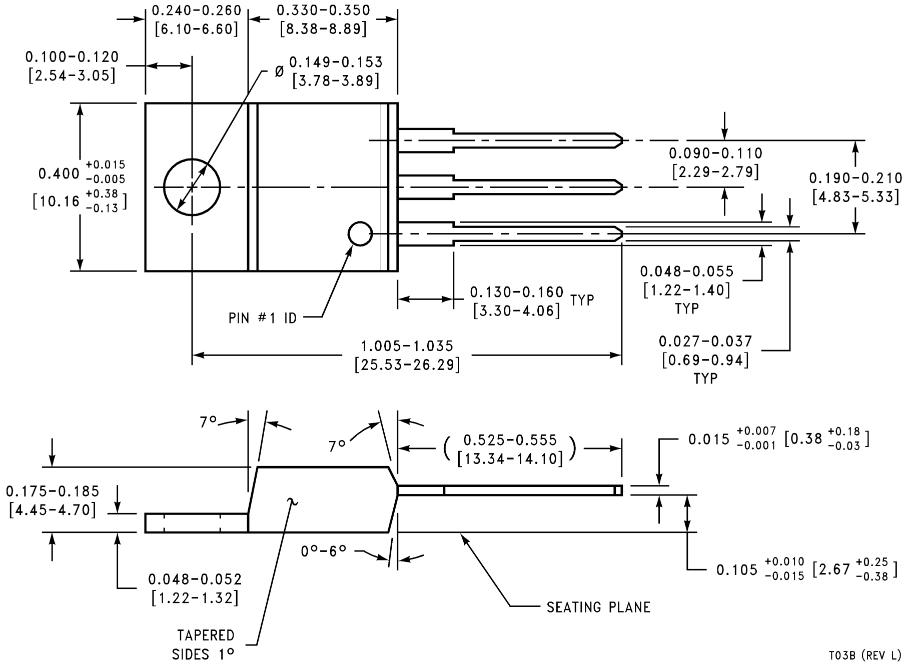
Note: Compared to IC regulator with 2.0V dropout voltage and I_{Qmax}, = 6.0 mA.

Physical Dimensions inches (millimeters) unless otherwise noted



TO Plastic Package
Order Number LM330T-5.0
NS Package Number T03B

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