LM330-N 3-Terminal Positive Regulator

Check for Samples: LM330-N

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**

DESCRIPTION

The LM330-N 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-N 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-N 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-N regulator cannot be harmed by a temporary mirror-image insertion.

Schematic and Connection Diagrams

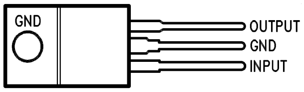
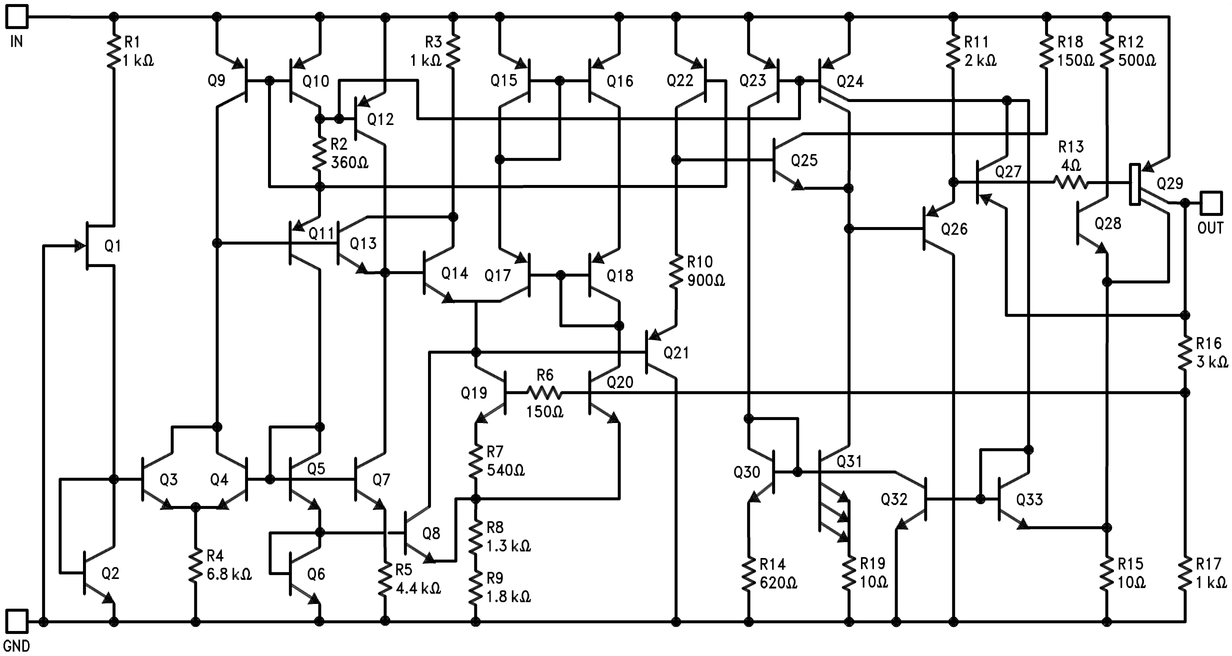


Figure 1. (TO-220)
Plastic Package
Front View
See Package Number NDE0003B



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings[1][2]

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

(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 ensure specific performance limits.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.

Electrical Characteristics[1]

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 $6 < V_{IN} < 26V$; $0°C \le T_j \le 100°C$	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	$V_{IN} = 40V$, $R_L = 100\Omega$, 1s		14		
	Reverse Polarity	$V_{IN} = -6V$, $R_L = 100\Omega$		−80		
ΔI_Q	Quiescent Current Change	$6 < V_{IN} < 26V$		10		%
V_{IN}	Overvoltage Shutdown Voltage		26	38		V
	Max Line Transient			60		
		1s, $V_o \le 5.5V$		50		
	Reverse Polarity Input Voltage			−30		
		DC $V_o > -0.3V$, $R_L = 100\Omega$		−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		

(1) 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 ($t_W \le 10$ ms, duty cycle ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

Typical Performance Characteristics

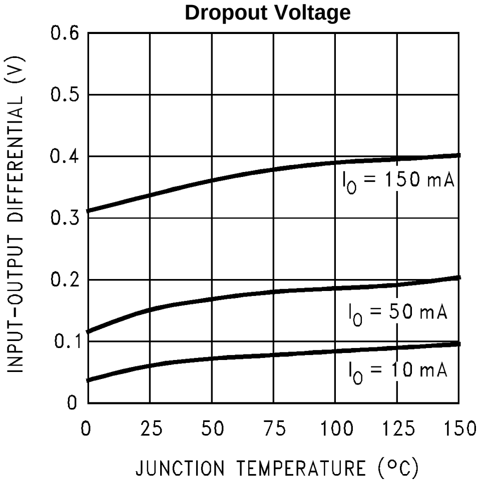


Figure 2.

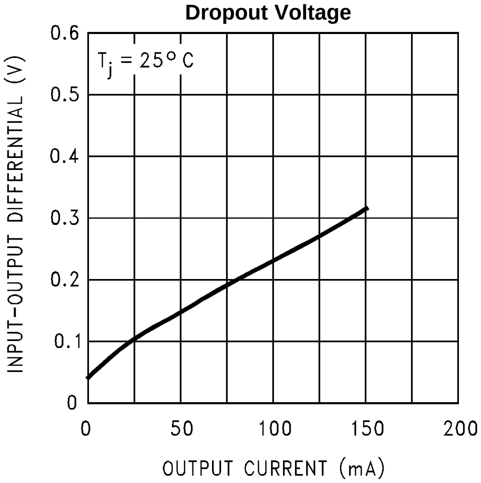


Figure 3.

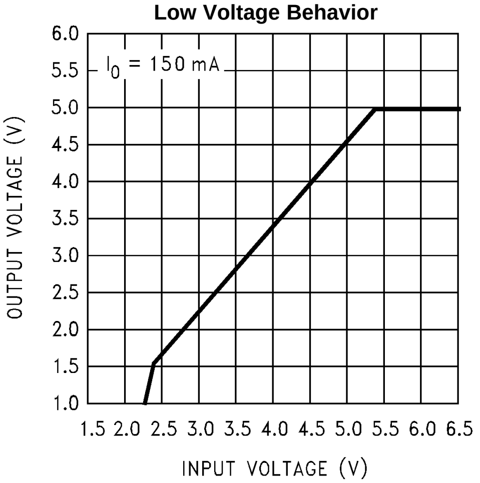


Figure 4.

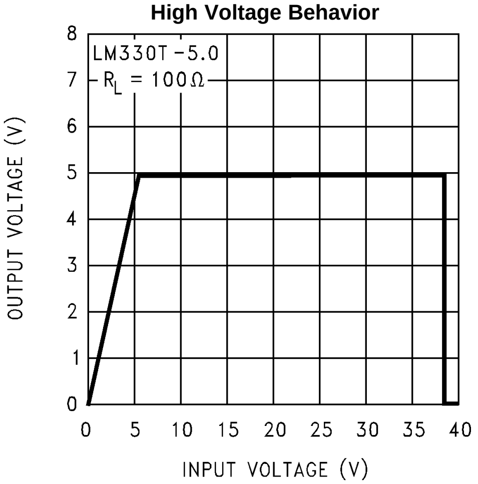


Figure 5.

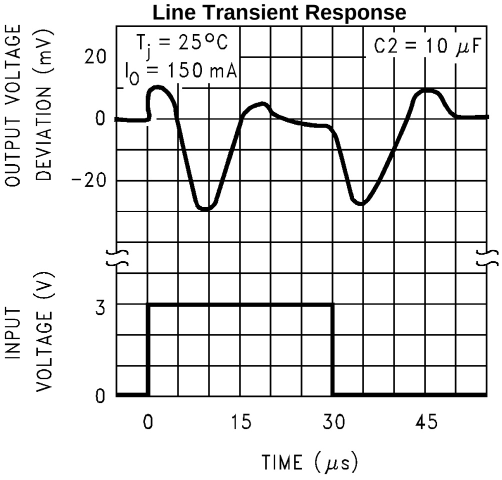


Figure 6.

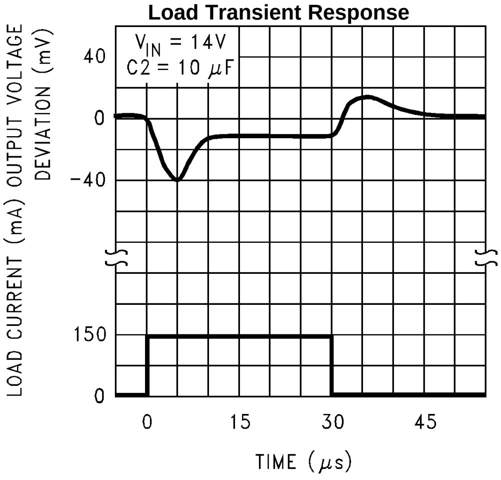


Figure 7.

Typical Performance Characteristics (continued)

Peak Output Current

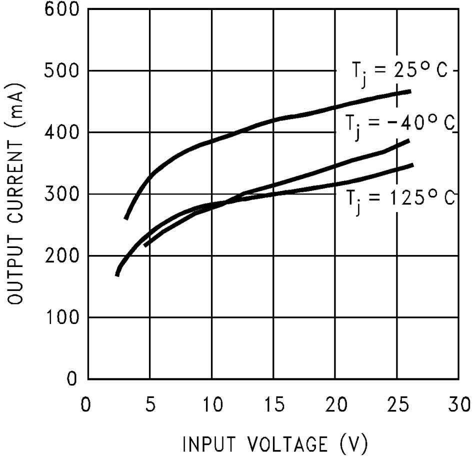


Figure 8.

Quiescent Current

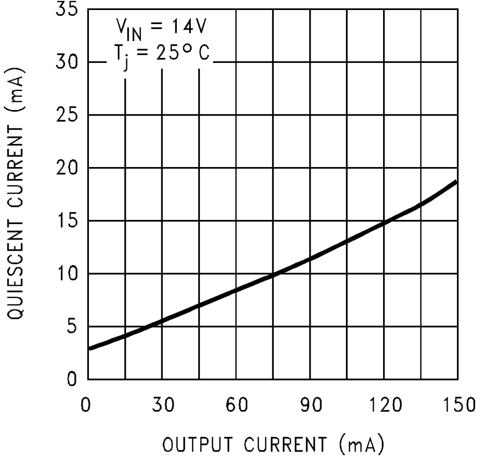


Figure 9.

Quiescent Current

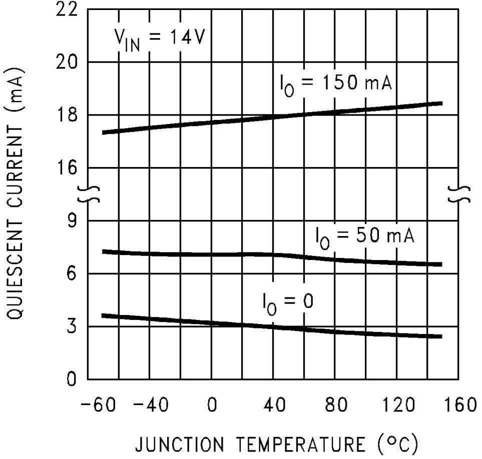


Figure 10.

Quiescent Current

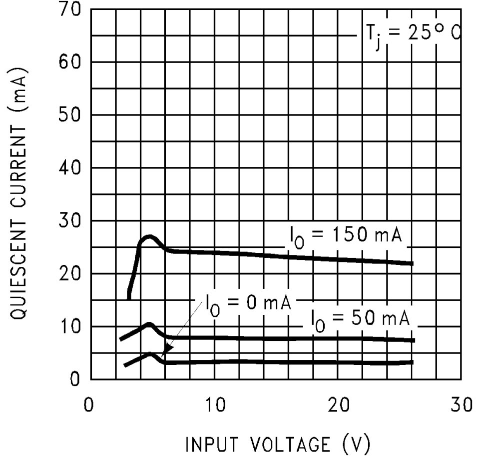


Figure 11.

Ripple Rejection

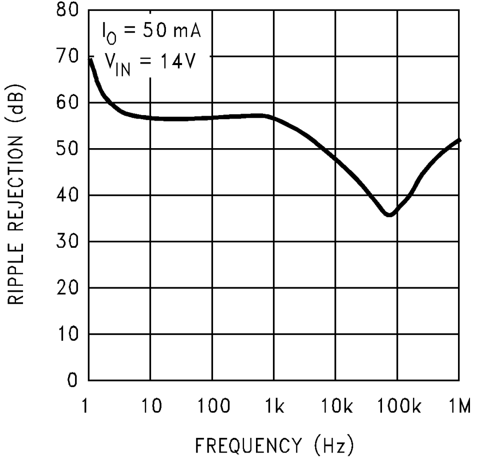


Figure 12.

Ripple Rejection

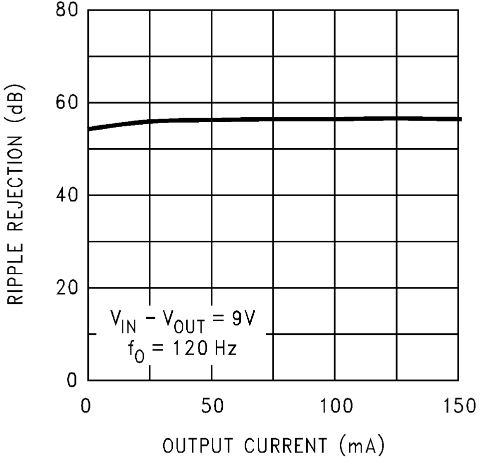


Figure 13.

Typical Performance Characteristics (continued)

Output Impedance

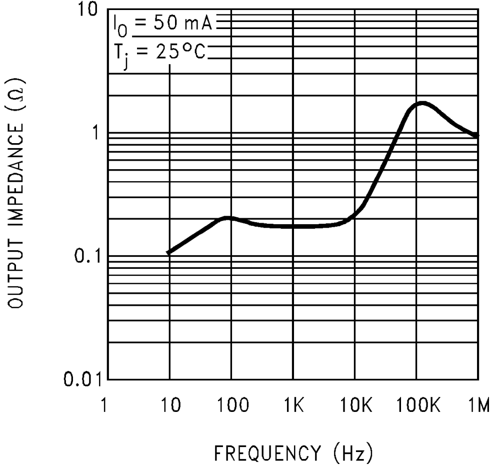


Figure 14.

Overvoltage Supply Current

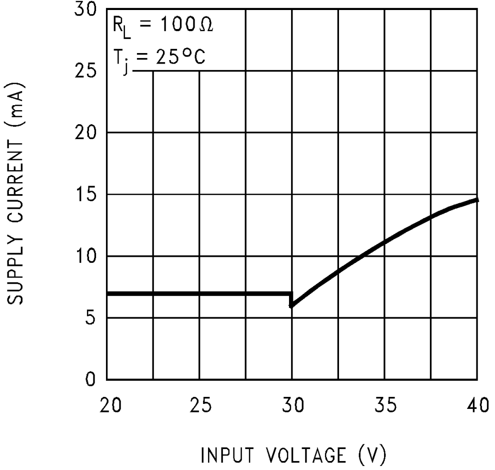


Figure 15.

Reverse Supply Current

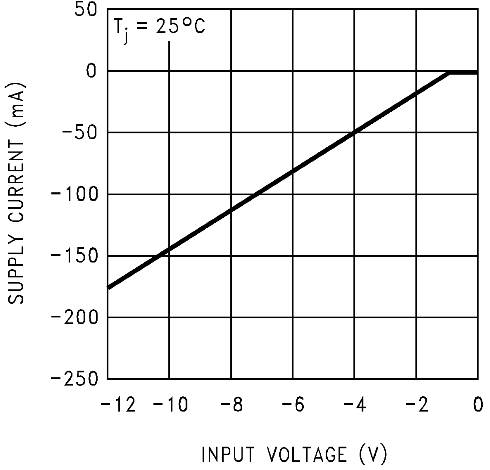


Figure 16.

Output at Reverse Supply

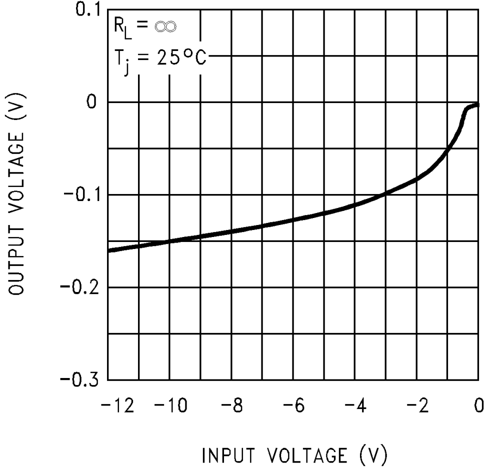


Figure 17.

Output at Overvoltage

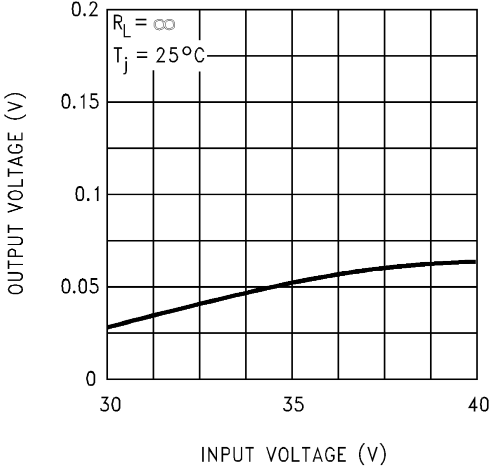


Figure 18.

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

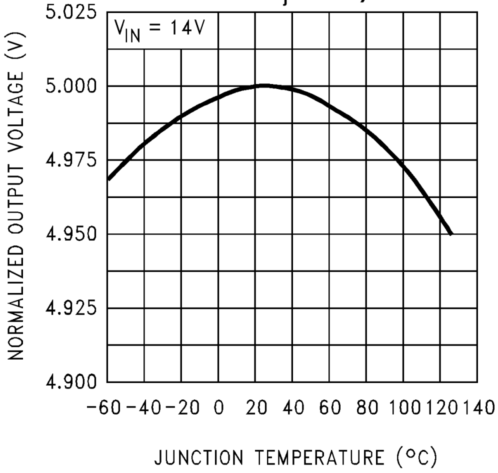
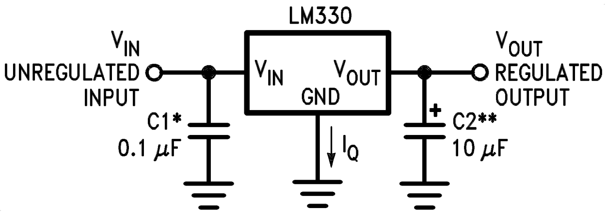


Figure 19.

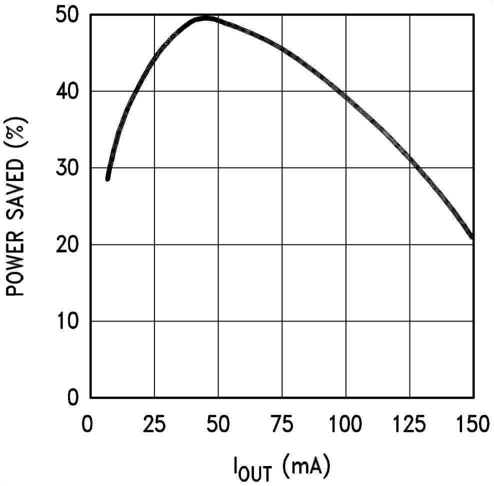
TYPICAL APPLICATIONS

The LM330-N 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-N 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-N allows the battery voltage to drop to within 0.3V of output voltage prior to the voltage regulator dropping out of regulation.



* 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 ensure 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.



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

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM330T-5.0	ACTIVE	TO-220	NDE	3	45	TBD	Call TI	Call TI	0 to 70	LM330T -5.0	Samples
LM330T-5.0/NOPB	ACTIVE	TO-220	NDE	3	45	Green (RoHS & no Sb/Br)	CU SN	Level-1-NA-UNLIM	0 to 70	LM330T -5.0	Samples

[1] The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

[4] Only one of markings shown within the brackets will appear on the physical device.

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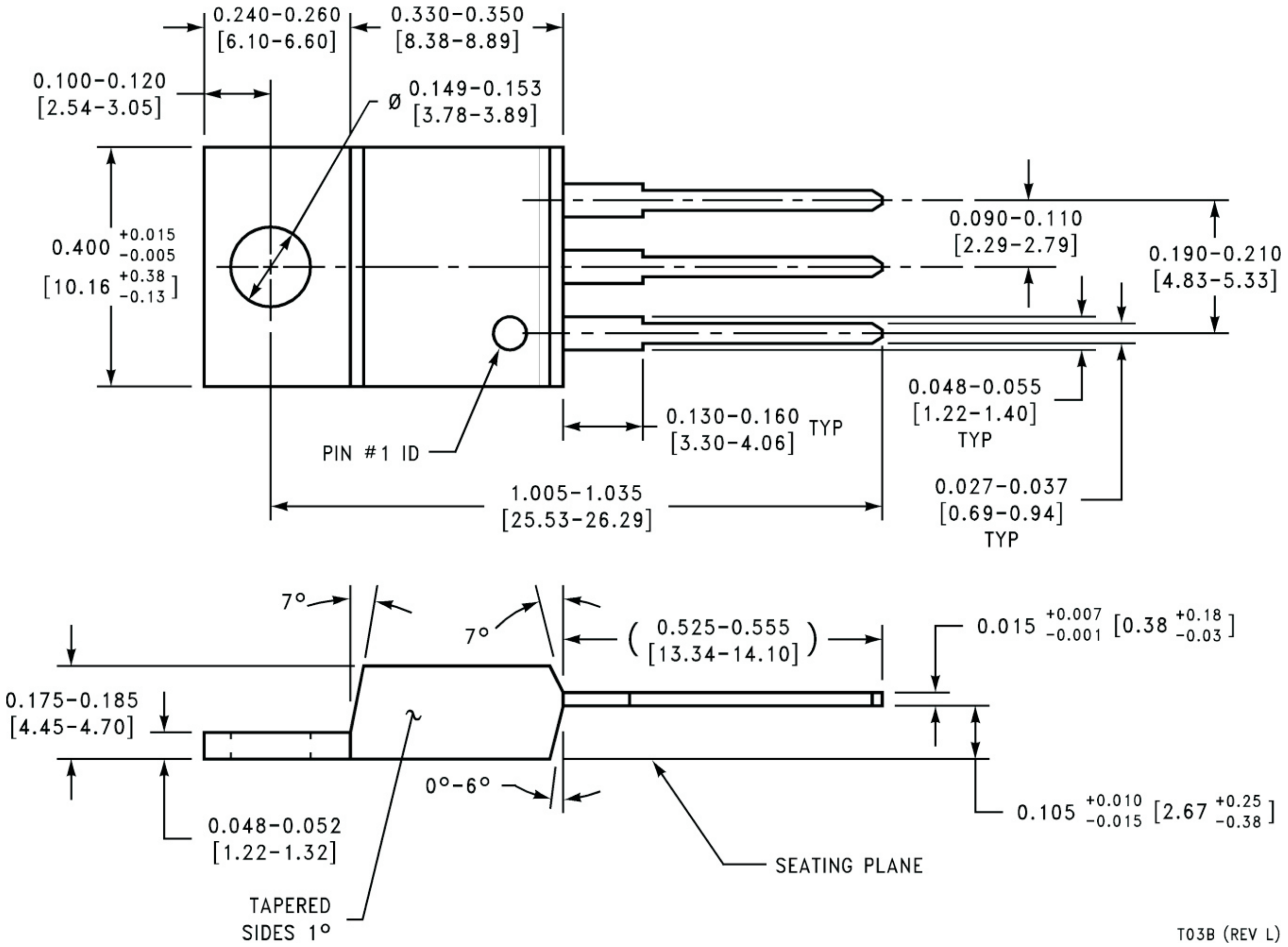
0.240–0.260
[6.10–6.60]
0.330–0.350
[8.38–8.89]
0.100–0.120
[2.54–3.05]
Ø 0.149–0.153
[3.78–3.89]
0.400 +0.015 −0.005
[10.16 +0.38 −0.13]
0.090–0.110
[2.29–2.79]
0.190–0.210
[4.83–5.33]
0.048–0.055
[1.22–1.40]
TYP
0.130–0.160 TYP
[3.30–4.06]
PIN #1 ID
1.005–1.035
[25.53–26.29]
0.027–0.037
[0.69–0.94]
TYP
7°
7°
(0.525–0.555 [13.34–14.10])
0.015 +0.007 −0.001 [0.38 +0.18 −0.03]
0.175–0.185
[4.45–4.70]
0°–6°
0.105 +0.010 −0.015 [2.67 +0.25 −0.38]
0.048–0.052
[1.22–1.32]
SEATING PLANE
TAPERED
SIDES 1°
T03B (REV L)

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