

## LM185-2.5-N/LM285-2.5-N/LM385-2.5-N Micropower Voltage Reference Diode

 Check for Samples: [LM185-2.5-N](#), [LM285-2.5-N](#), [LM385-2.5-N](#)

### FEATURES

- $\pm 20$  mV ( $\pm 0.8\%$ ) max. Initial Tolerance (A Grade)
- Operating Current of 20  $\mu$ A to 20 mA
- 0.6 $\Omega$  Dynamic Impedance (A Grade)
- Low Temperature Coefficient
- Low Voltage Reference—2.5V
- 1.2V Device and Adjustable Device Also Available—LM185-1.2 Series and LM185 Series, respectively

### DESCRIPTION

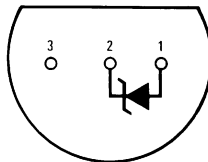
The LM185-2.5-N/LM285-2.5-N/LM385-2.5-N are micropower 2-terminal band-gap voltage regulator diodes. Operating over a 20  $\mu$ A to 20 mA current range, they feature exceptionally low dynamic impedance and good temperature stability. On-chip trimming is used to provide tight voltage tolerance. Since the LM-185-2.5-N band-gap reference uses only transistors and resistors, low noise and good long term stability result.

Careful design of the LM185-2.5-N has made the device exceptionally tolerant of capacitive loading, making it easy to use in almost any reference application. The wide dynamic operating range allows its use with widely varying supplies with excellent regulation.

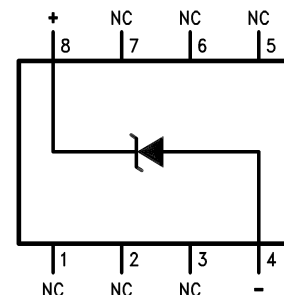
The extremely low power drain of the LM185-2.5-N makes it useful for micropower circuitry. This voltage reference can be used to make portable meters, regulators or general purpose analog circuitry with battery life approaching shelf life. Further, the wide operating current allows it to replace older references with a tighter tolerance part. For applications requiring 1.2V see LM185-1.2.

The LM185-2.5-N is rated for operation over a  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  temperature range while the LM285-2.5-N is rated  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  and the LM385-2.5-N  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ . The LM185-2.5-N/LM285-2.5-N are available in a hermetic TO package and the LM285-2.5-N/LM385-2.5-N are also available in a low-cost TO-92 molded package, as well as SOIC and SOT-23. The LM185-2.5-N is also available in a hermetic leadless chip carrier package.

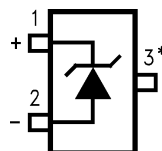
### Connection Diagram



**Figure 1. TO-92 Package  
(Bottom View)  
See Package Number LP0003A**



**Figure 2. SOIC Package  
See Package Number D0008A**



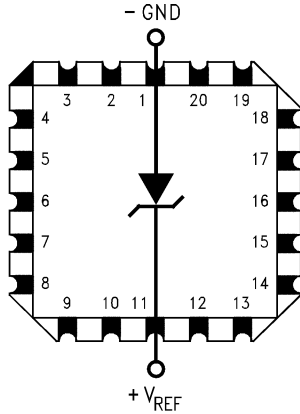
\* Pin 3 is attached to the Die Attach Pad (DAP) and should be connected to Pin 2 or left floating.

**Figure 3. SOT-23**

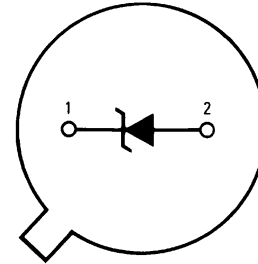


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

All trademarks are the property of their respective owners.



**Figure 4. LCCC Leadless Chip Carrier**  
See Package Number NAJ0020A



**Figure 5. TO Package (Bottom View)**  
See Package Number NDU0002A



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** <sup>(1)(2)(3)</sup>

Reverse Current		30 mA	
Forward Current		10 mA	
Operating Temperature Range <sup>(4)</sup>	LM185-2.5-N	-55°C to + 125°C	
	LM285-2.5-N	-40°C to + 85°C	
	LM385-2.5-N	0°C to 70°C	
ESD Susceptibility <sup>(5)</sup>		2kV	
Storage Temperature		-55°C to + 150°C	
Soldering Information	TO-92 Package (10 sec.)		260°C
	TO Package (10 sec.)		300°C
	SOIC and SOT-23 Package	Vapor Phase (60 sec.)	215°C
		Infrared (15 sec.)	220°C

See <http://www.ti.com> for other methods of soldering surface mount devices.

- (1) Refer to RETS185H-2.5 for military specifications.
- (2) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics. The ensured specifications apply only for the test conditions listed.
- (3) If Military/Aerospace specified devices are required, please contact the TI Sales Office/Distributors for availability and specifications.
- (4) For elevated temperature operation,  $T_{J\ MAX}$  is:  
 LM185-N: 150°C  
 LM285-N: 125°C  
 LM385-N: 100°C  
 See [THERMAL CHARACTERISTICS](#).
- (5) The human body model is a 100 pF capacitor discharged through a 1.5 kΩ resistor into each pin.

**THERMAL CHARACTERISTICS**

over operating free-air temperature range (unless otherwise noted)

Thermal Resistance	LM185	150°C	SOIC-8	SOT-23
	LM285	125°C		
	LM385	100°C		
	TO-92	TO		
$\theta_{ja}$ (Junction to Ambient)	180°C/W (0.4" Leads)	440°C/W	165°C/W	283°C/W
	170°C/W (0.125" Leads)			
$\theta_{jc}$ (Junction to Case)	N/A	80°C/W	N/A	N/A

**ELECTRICAL CHARACTERISTICS**

Parameter	Conditions	Typ	LM385A-2.5-N		Units (Limits)
			LM385AX-2.5-N		
			LM385AY-2.5-N		
			Tested Limit <sup>(2)</sup>	Design Limit <sup>(3)</sup>	
Reverse Breakdown Voltage	$I_R = 100 \mu\text{A}$	2.500  <b>2.500</b>	2.480 2.520	<b>2.470</b> <b>2.530</b>	V(Min) V(Max) V(Min) V(Max)
Minimum Operating Current		12	18	<b>20</b>	$\mu\text{A}$ (Max)
Reverse Breakdown Voltage Change with Current	$I_{\text{MIN}} \leq I_R \leq 1\text{mA}$		1	<b>1.5</b>	mV (Max)
	$1\text{mA} \leq I_R \leq 20\text{mA}$		10	<b>20</b>	mV (Max)
Reverse Dynamic Impedance	$I_R = 100 \mu\text{A}$ , $f = 20\text{Hz}$	0.2		0.6 <b>1.5</b>	$\Omega$
Wideband Noise (rms)	$I_R = 100 \mu\text{A}$ $10\text{Hz} \leq f \leq 10\text{kHz}$	120			$\mu\text{V}$
Long Term Stability	$I_R = 100 \mu\text{A}$ , $T = 1000\text{Hr}$ , $T_A = 25^\circ\text{C} \pm 0.1^\circ\text{C}$	20			ppm
Average Temperature Coefficient <sup>(4)</sup>	$I_{\text{MIN}} \leq I_R \leq 20\text{mA}$ X Suffix Y Suffix All Others				
			<b>30</b>		ppm/ $^\circ\text{C}$
			<b>50</b>		(Max)
				<b>150</b>	

(1) Parameters identified with boldface type apply at temperature extremes. All other numbers apply at  $T_A = T_J = 25^\circ\text{C}$ .

(2) Specified and 100% production tested.

(3) Specified, but not 100% production tested. These limits are not used to calculate average outgoing quality levels.

(4) The average temperature coefficient is defined as the maximum deviation of reference voltage at all measured temperatures between the operating  $T_{\text{MAX}}$  and  $T_{\text{MIN}}$ , divided by  $T_{\text{MAX}} - T_{\text{MIN}}$ . The measured temperatures are  $-55^\circ\text{C}$ ,  $-40^\circ\text{C}$ ,  $0^\circ\text{C}$ ,  $25^\circ\text{C}$ ,  $70^\circ\text{C}$ ,  $85^\circ\text{C}$ ,  $125^\circ\text{C}$ .

**ELECTRICAL CHARACTERISTICS**

Parameter	Conditions	Typ	LM185-2.5-N		LM385B-2.5-N		LM385-2.5-N		Units (Limit)
			LM185BX-2.5-N		LM385BX-2.5-N				
			LM185BY-2.5-N		LM385BY-2.5-N				
			LM285-2.5-N		LM285BY-2.5-N				
			LM285BX-2.5-N		LM285BY-2.5-N				
			Tested Limit <sup>(1)(2)</sup>	Design Limit <sup>(3)</sup>	Tested Limit <sup>(1)</sup>	Design Limit <sup>(3)</sup>	Tested Limit <sup>(1)</sup>	Design Limit <sup>(3)</sup>	
Reverse Breakdown Voltage	T <sub>A</sub> = 25°C, 20 μA ≤ I <sub>R</sub> ≤ 20 mA	2.5	2.462 2.538		2.462 2.538		2.425 2.575		V(Min) V(Max)
Minimum Operating Current	LM385M3-2.5-N	13	20	<b>30</b>	20	<b>30</b>	20 15	<b>30</b> <b>20</b>	μA (Max)
Reverse Breakdown Voltage Change with Current	20 μA ≤ I <sub>R</sub> ≤ 1 mA 1 mA ≤ I <sub>R</sub> ≤ 20 mA		1 10	<b>1.5</b> <b>20</b>	2.0 20	<b>2.5</b> <b>25</b>	2.0 20	<b>2.5</b> <b>25</b>	mV (Max) mV (Max)
Reverse Dynamic Impedance	I <sub>R</sub> = 100 μA, f = 20 Hz	1							Ω
Wideband Noise (rms)	I <sub>R</sub> = 100 μA, 10 Hz ≤ f ≤ 10 kHz	120							μV
Long Term Stability	I <sub>R</sub> = 100 μA, T = 1000 Hr, T <sub>A</sub> = 25°C ±0.1°C	20							ppm
Average Temperature Coefficient <sup>(4)</sup>	I <sub>R</sub> = 100 μA X Suffix Y Suffix All Others		<b>30</b> <b>50</b>	<b>150</b>	<b>30</b> <b>50</b>	<b>150</b>		<b>150</b>	ppm/°C ppm/°C ppm/°C (Max)

- (1) Specified and 100% production tested.
- (2) A military RETS electrical specification available on request.
- (3) Specified, but not 100% production tested. These limits are not used to calculate average outgoing quality levels.
- (4) The average temperature coefficient is defined as the maximum deviation of reference voltage at all measured temperatures between the operating T<sub>MAX</sub> and T<sub>MIN</sub>, divided by T<sub>MAX</sub>–T<sub>MIN</sub>. The measured temperatures are –55°C, –40°C, 0°C, 25°C, 70°C, 85°C, 125°C.

TYPICAL PERFORMANCE CHARACTERISTICS

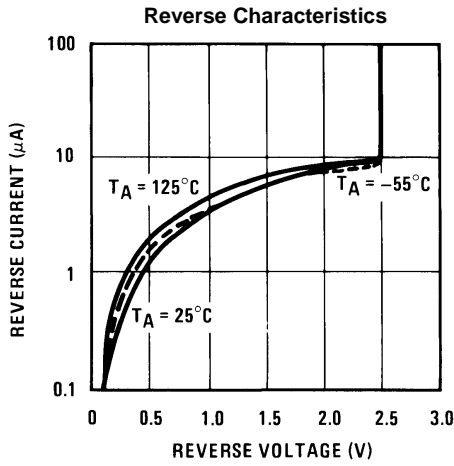


Figure 6.

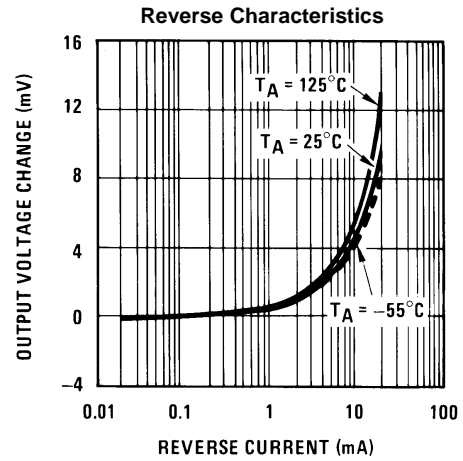


Figure 7.

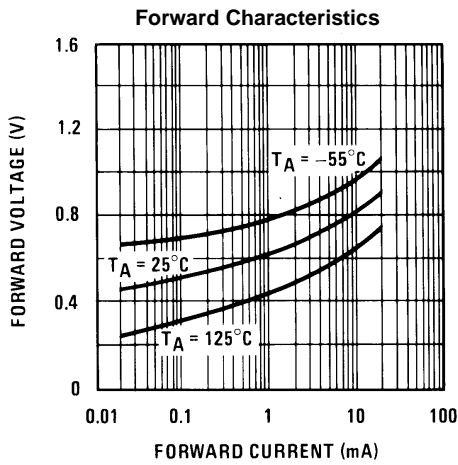


Figure 8.

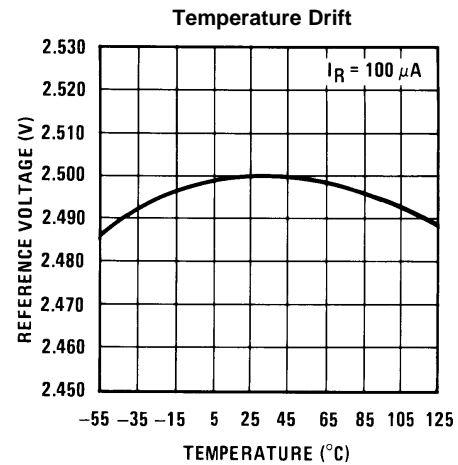


Figure 9.

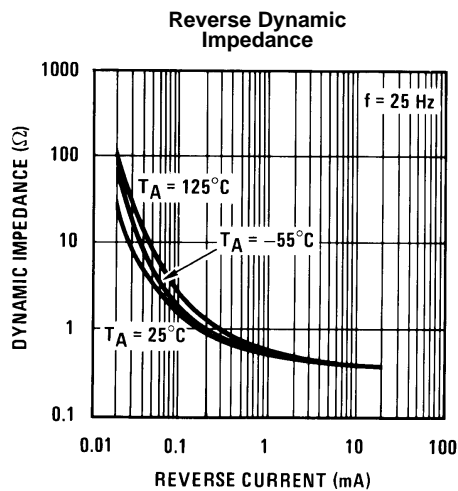


Figure 10.

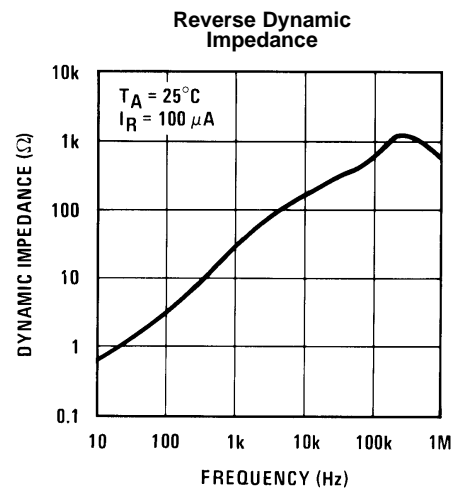


Figure 11.

**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

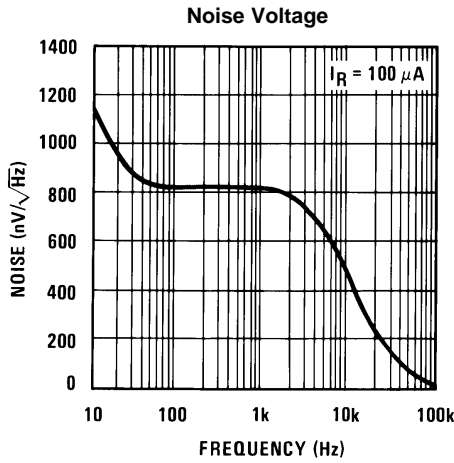


Figure 12.

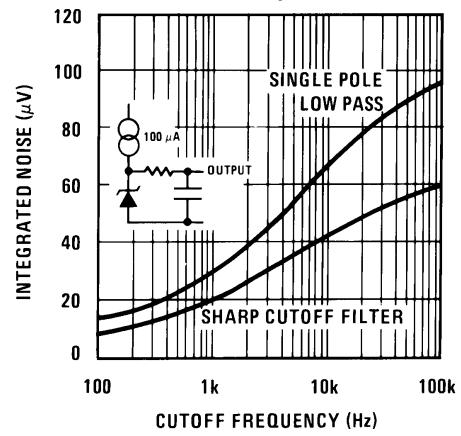


Figure 13.

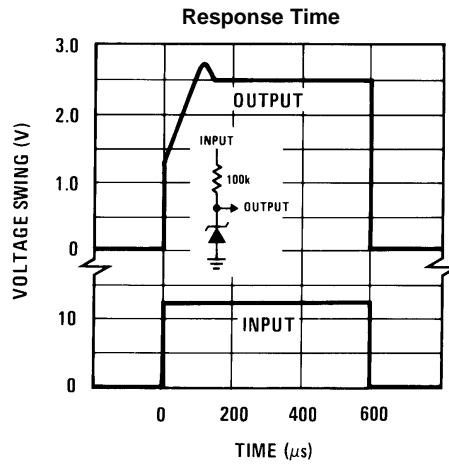


Figure 14.

APPLICATIONS

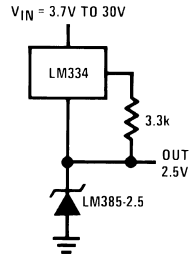


Figure 15. Wide Input Range Reference

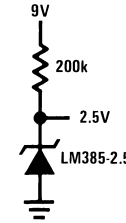
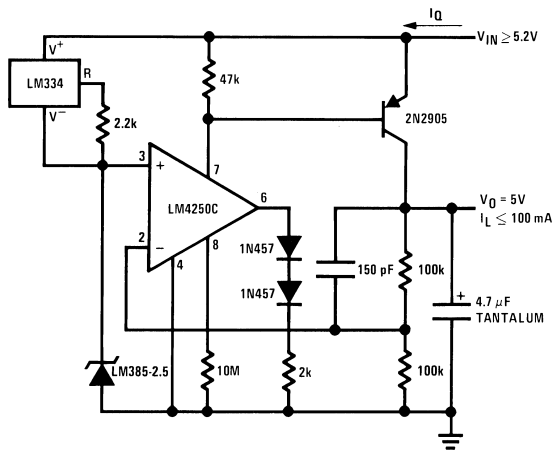


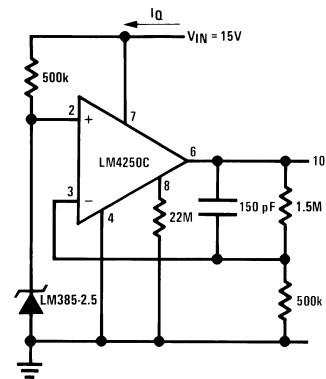
Figure 16. Micropower Reference from 9V Battery

LM385-2.5-N Applications



$I_Q \approx 40 \mu A$

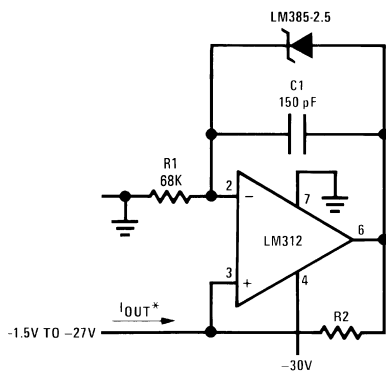
Figure 17. Micropower 5V Reference



$I_Q \approx 30 \mu A$  standby current

Figure 18. Micropower 10V Reference

PRECISION 1  $\mu A$  to 1 mA CURRENT SOURCES



$$I_{OUT} = \frac{2.5V}{R2}$$

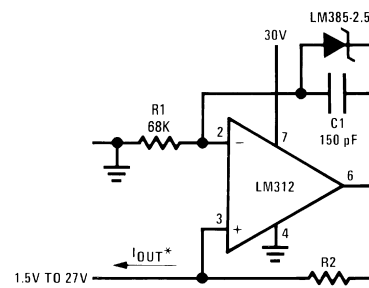
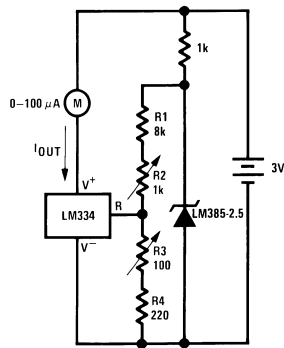


Figure 19.

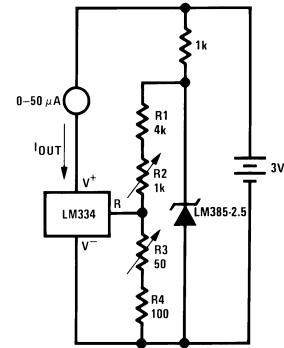
METER THERMOMETERS



Calibration

1. Short LM385-2.5-N, adjust R3 for  $I_{OUT} = \text{temp}$  at  $1 \mu\text{A}/^\circ\text{C}$ .
2. Remove short, adjust R2 for correct reading in centigrade

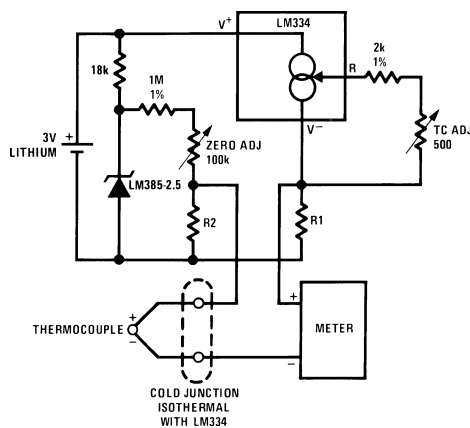
**Figure 20. 0°C–100°C Thermometer**



Calibration

1. Short LM385-2.5-N, adjust R3 for  $I_{OUT} = \text{temp}$  at  $1.8 \mu\text{A}/^\circ\text{C}$
2. Remove short, adjust R2 for correct reading in °F

**Figure 21. 0°F–50°F Thermometer**



Adjustment Procedure

1. Adjust TC ADJ pot until voltage across R1 equals Kelvin temperature multiplied by the thermocouple Seebeck coefficient.
2. Adjust zero ADJ pot until voltage across R2 equals the thermocouple Seebeck coefficient multiplied by 273.2.

**Figure 22. Micropower Thermocouple Cold Junction Compensator**

Thermocouple Type <sup>(1)</sup>	Seebeck Coefficient ( $\mu\text{V}/^\circ\text{C}$ )	R1 ( $\Omega$ )	R2 ( $\Omega$ )	Voltage Across R1 @ 25°C (mV)	Voltage Across R2 (mV)
J	52.3	523	1.24k	15.60	14.32
T	42.8	432	1k	12.77	11.78
K	40.8	412	953 $\Omega$	12.17	11.17
S	6.4	63.4	150 $\Omega$	1.908	1.766

(1) Typical supply current 50  $\mu\text{A}$



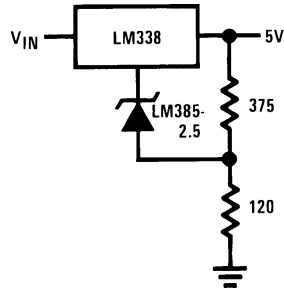
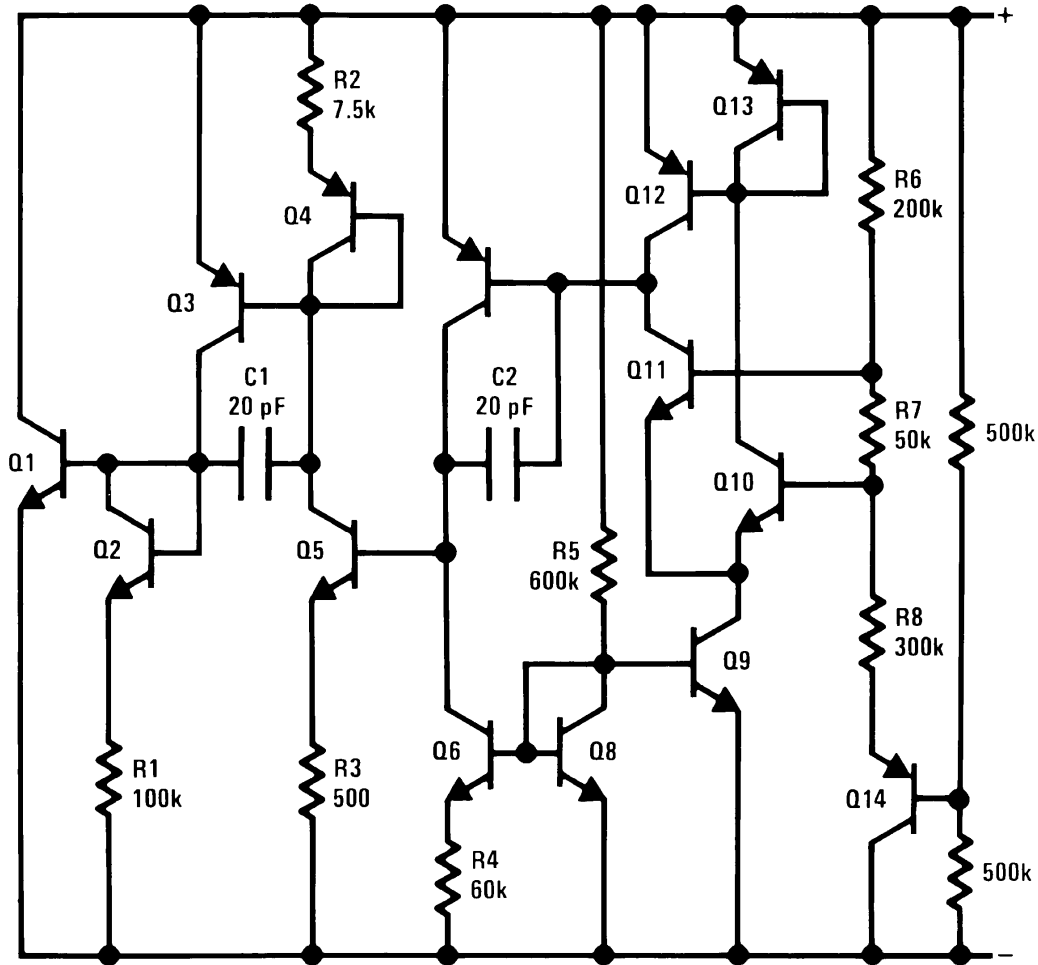


Figure 23. Improving Regulation of Adjustable Regulators

Schematic Diagram



## REVISION HISTORY

Changes from Revision C (March 2013) to Revision D	Page
• Changed layout of National Data Sheet to TI format .....	<a href="#">9</a>

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM285BXM-2.5/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	285BX M2.5	<a href="#">Samples</a>
LM285BXM-2.5/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	285BX M2.5	<a href="#">Samples</a>
LM285BXZ-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	-40 to 85	285BX Z2.5	<a href="#">Samples</a>
LM285BYM-2.5/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	285BY M2.5	<a href="#">Samples</a>
LM285BYM-2.5/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	285BY M2.5	<a href="#">Samples</a>
LM285BYZ-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	-40 to 85	285BY Z2.5	<a href="#">Samples</a>
LM285M-2.5/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM285 M2.5	<a href="#">Samples</a>
LM285MX-2.5/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM285 M2.5	<a href="#">Samples</a>
LM285Z-2.5/LFT7	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type		LM285 Z-2.5	<a href="#">Samples</a>
LM285Z-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	-40 to 85	LM285 Z-2.5	<a href="#">Samples</a>
LM385BM-2.5/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM385 BM2.5	<a href="#">Samples</a>
LM385BMX-2.5	NRND	SOIC	D	8	2500	TBD	Call TI	Call TI	0 to 70	LM385 BM2.5	
LM385BMX-2.5/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM385 BM2.5	<a href="#">Samples</a>
LM385BXM-2.5	NRND	SOIC	D	8	95	TBD	Call TI	Call TI	0 to 70	385BX M2.5	
LM385BXM-2.5/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	385BX M2.5	<a href="#">Samples</a>
LM385BXM-2.5/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	385BX M2.5	<a href="#">Samples</a>
LM385BXZ-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	0 to 70	385BX Z-2.5	<a href="#">Samples</a>

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM385BYM-2.5/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	385BY M2.5	<a href="#">Samples</a>
LM385BYMX-2.5/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	385BY M2.5	<a href="#">Samples</a>
LM385BYZ-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	0 to 70	385BY Z-2.5	<a href="#">Samples</a>
LM385BZ-2.5/LFT7	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type		LM385 BZ2.5	<a href="#">Samples</a>
LM385BZ-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	0 to 70	LM385 BZ2.5	<a href="#">Samples</a>
LM385M-2.5/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM385 M2.5	<a href="#">Samples</a>
LM385M3-2.5	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI	0 to 70	R12	
LM385M3-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	R12	<a href="#">Samples</a>
LM385M3X-2.5	NRND	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI	0 to 70	R12	
LM385M3X-2.5/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	R12	<a href="#">Samples</a>
LM385MX-2.5	NRND	SOIC	D	8		TBD	Call TI	Call TI	0 to 70	LM385 M2.5	
LM385MX-2.5/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM385 M2.5	<a href="#">Samples</a>
LM385Z-2.5/LFT1	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type		LM385 Z2.5	<a href="#">Samples</a>
LM385Z-2.5/LFT2	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type		LM385 Z2.5	<a href="#">Samples</a>
LM385Z-2.5/LFT3	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type		LM385 Z2.5	<a href="#">Samples</a>
LM385Z-2.5/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	0 to 70	LM385 Z2.5	<a href="#">Samples</a>

(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.

**OBSELETE:** 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) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

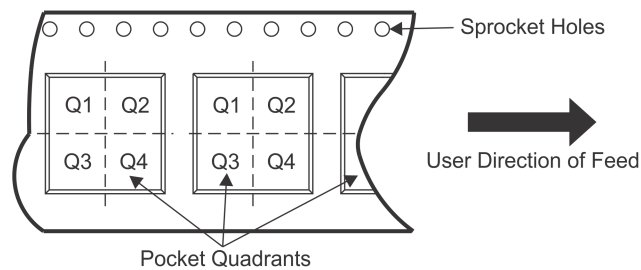
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM285BXM-2.5/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM285BYM-2.5/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM285MX-2.5/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM385BMX-2.5	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM385BMX-2.5/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM385BXM-2.5/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM385BYM-2.5/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM385M3-2.5	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM385M3-2.5/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM385M3X-2.5	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM385M3X-2.5/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM385MX-2.5/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**

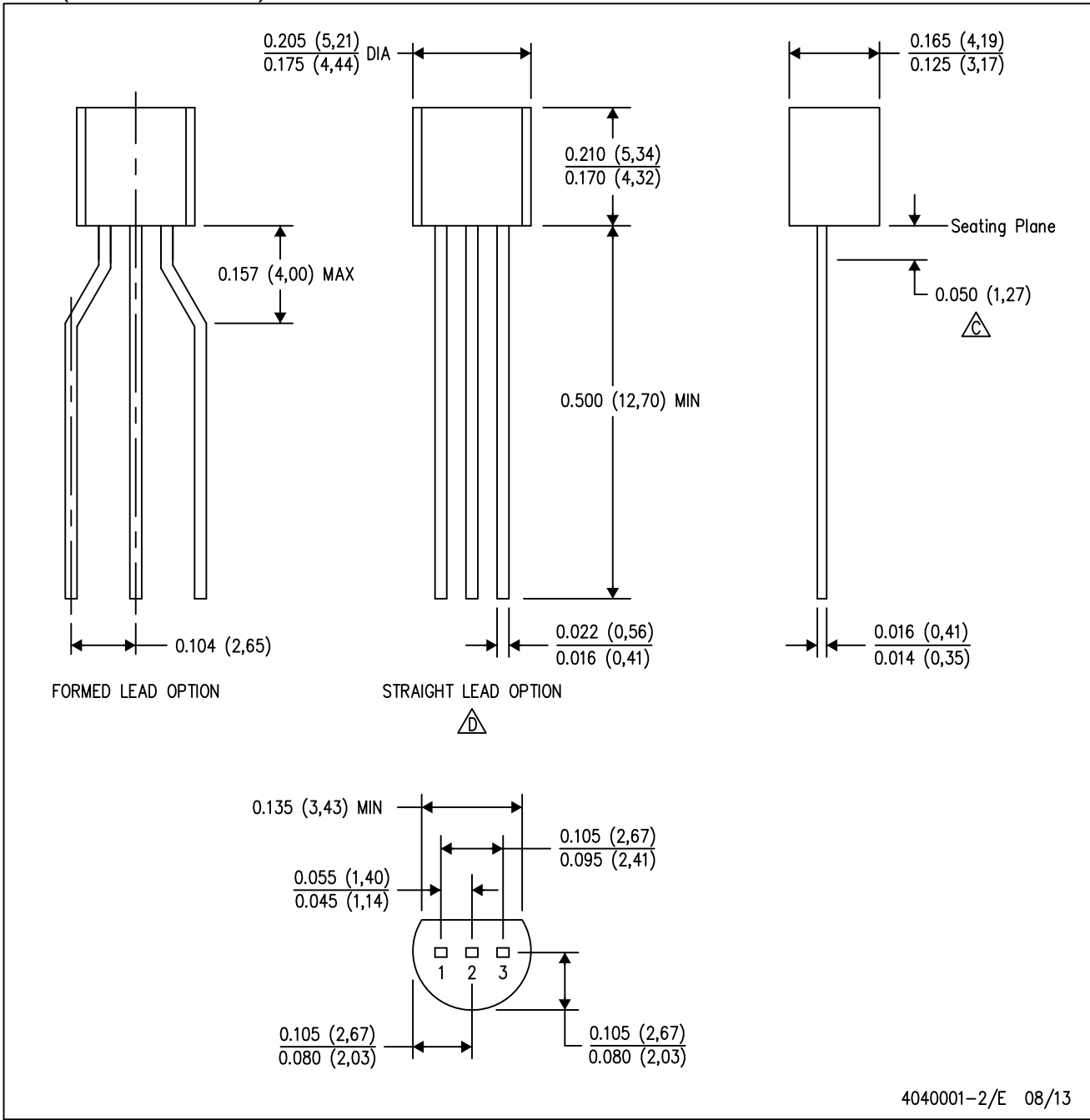

\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM285BXM3-2.5/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM285BYM3-2.5/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM285M3-2.5/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM385BM3-2.5	SOIC	D	8	2500	367.0	367.0	35.0
LM385BM3-2.5/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM385BXM3-2.5/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM385BYM3-2.5/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM385M3-2.5	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM385M3-2.5/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM385M3X-2.5	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM385M3X-2.5/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM385M3-2.5/NOPB	SOIC	D	8	2500	367.0	367.0	35.0



**MECHANICAL DATA**

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



4040001-2/E 08/13

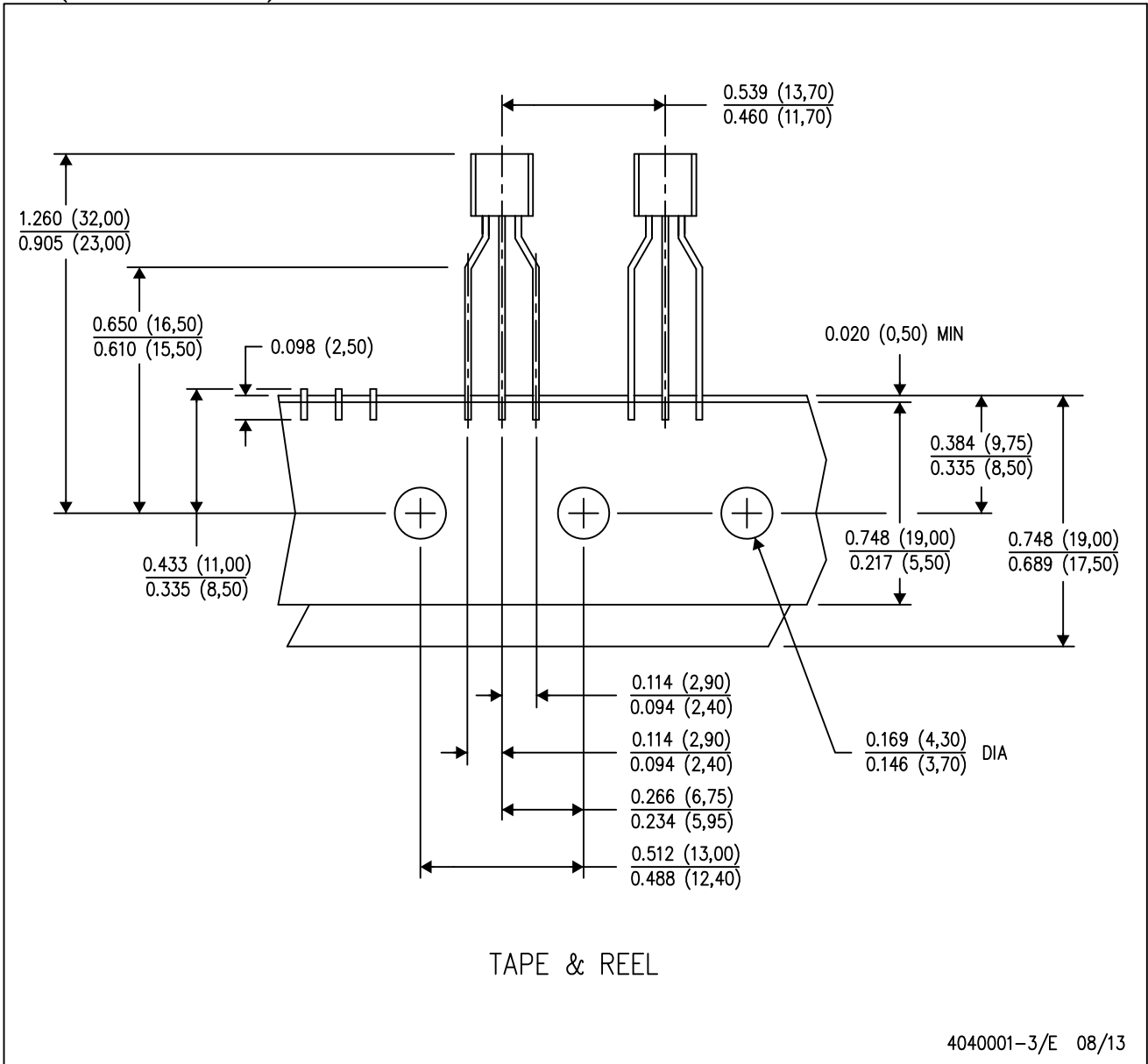
- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  Lead dimensions are not controlled within this area.
  -  Falls within JEDEC TO-226 Variation AA (TO-226 replaces TO-92).
  - E. Shipping Method:  
 Straight lead option available in bulk pack only.  
 Formed lead option available in tape & reel or ammo pack.  
 Specific products can be offered in limited combinations of shipping mediums and lead options.  
 Consult product folder for more information on available options.



**MECHANICAL DATA**

LP (O-PBCY-W3)

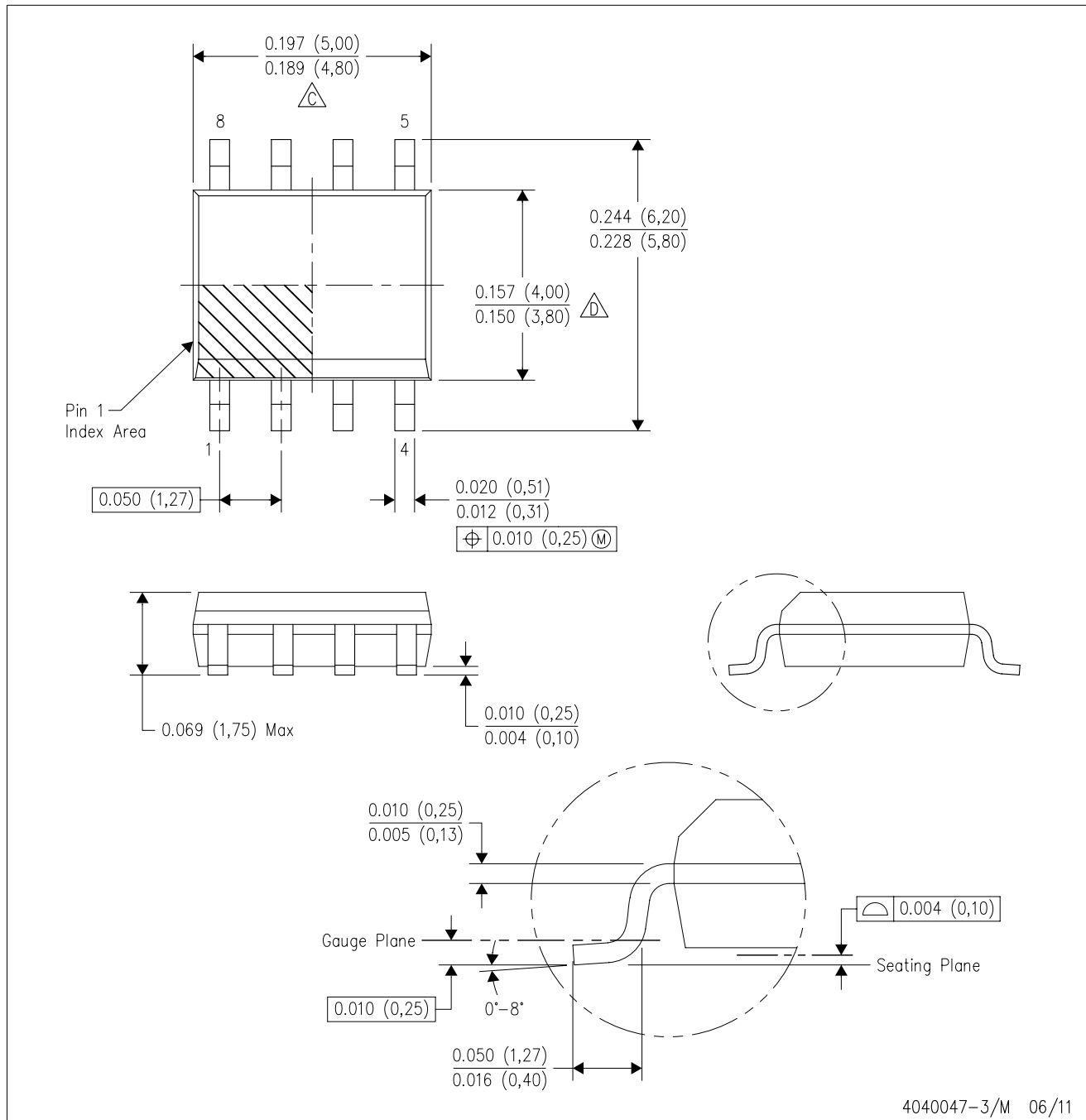
PLASTIC CYLINDRICAL PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Tape and Reel information for the Formed Lead Option package.

D (R-PDSO-G8)

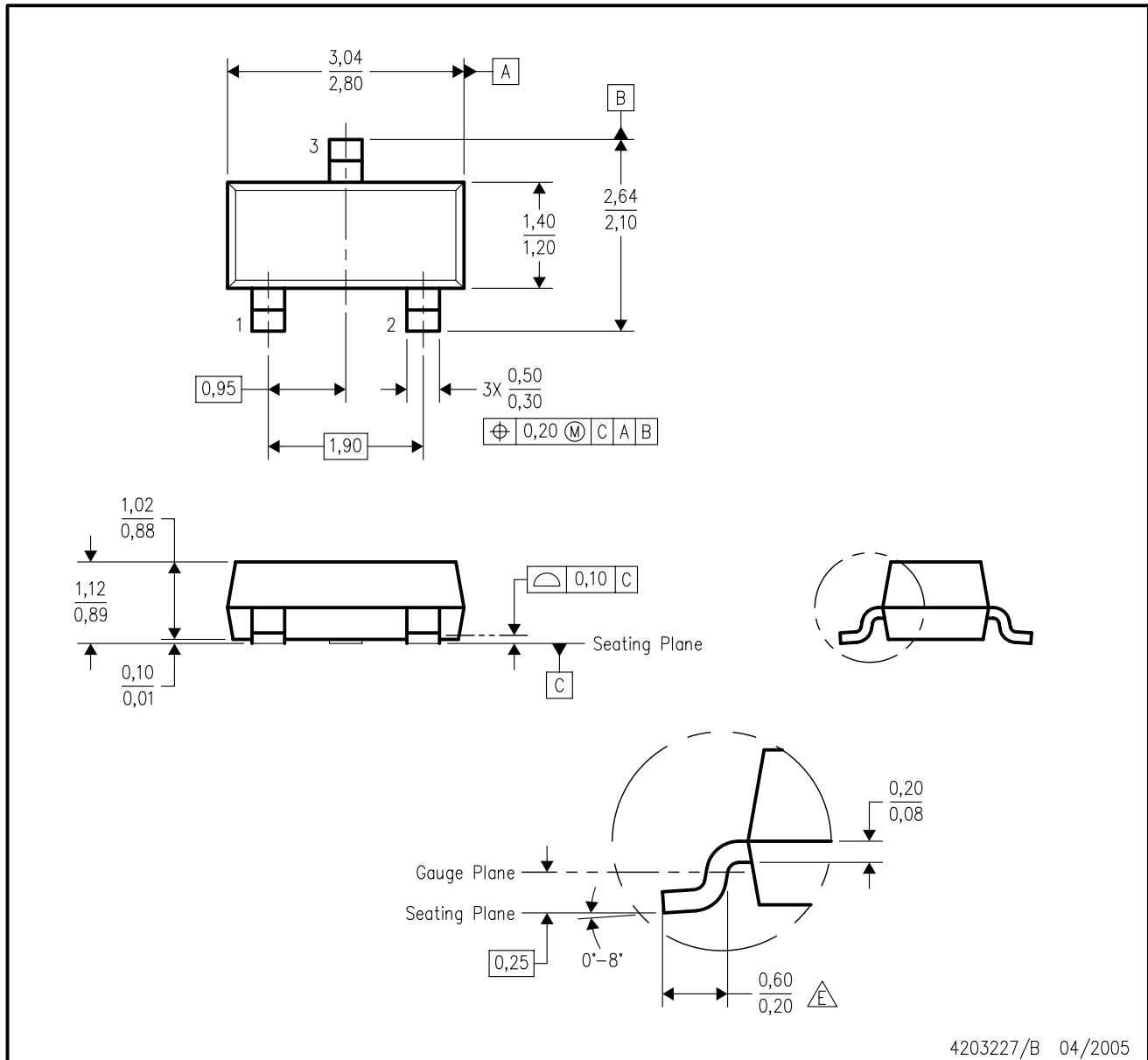
PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.  
 D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.  
 E. Reference JEDEC MS-012 variation AA.

DBZ (R-PDSO-G3)

PLASTIC SMALL-OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Lead dimensions are inclusive of plating.
  - D. Body dimensions are exclusive of mold flash and protrusion. Mold flash and protrusion not to exceed 0.25 per side.
  - E. Falls within JEDEC TO-236 variation AB, except minimum foot length.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)