

LM185-1.2-N/LM285-1.2-N/LM385-1.2-N Micropower Voltage Reference Diode

 Check for Samples: [LM185-1.2-N](#), [LM285-1.2-N](#), [LM385-1.2-N](#)

FEATURES

- $\pm 1\%$ and 2% Initial Tolerance
- Operating Current of $10\mu\text{A}$ to 20mA
- 1Ω Dynamic Impedance
- Low Temperature Coefficient
- Low Voltage Reference— 1.235V
- 2.5V Device and Adjustable Device Also Available
- LM185-2.5 Series and LM185 Series, respectively

DESCRIPTION

The LM185-1.2-N/LM285-1.2-N/LM385-1.2-N are micropower 2-terminal band-gap voltage regulator diodes. Operating over a $10\mu\text{A}$ to 20mA current range, they feature exceptionally low dynamic impedance and good temperature stability. On-chip trimming is used to provide tight voltage tolerance. Since the LM185-1.2-N band-gap reference uses only transistors and resistors, low noise and good long term stability result.

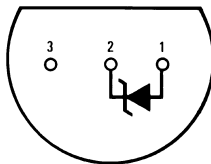
Careful design of the LM185-1.2-N has made the device exceptionally tolerant of capacitive loading, making it easy to use in almost any reference application. The wide dynamic operating range allows its use with widely varying supplies with excellent regulation.

The extremely low power drain of the LM185-1.2-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.

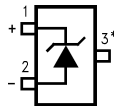
Further, the wide operating current allows it to replace older references with a tighter tolerance part.

The LM185-1.2-N is rated for operation over a -55°C to 125°C temperature range while the LM285-1.2-N is rated -40°C to 85°C and the LM385-1.2-N 0°C to 70°C . The LM185-1.2-N/LM285-1.2-N are available in a hermetic TO package and the LM285-1.2-N/LM385-1.2-N are also available in a low-cost TO-92 molded package, as well as SOIC and SOT-23.

CONNECTION DIAGRAM



**Figure 1. T0-92 Package (LP)
(Bottom View)**



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

Figure 2. SOT-23

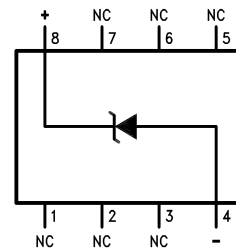
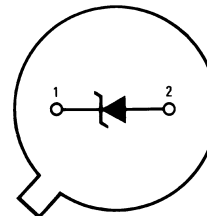


Figure 3. SOIC Package



**Figure 4. TO Package (NDV)
(Bottom View)**



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.



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⁾⁽³⁾

Reverse Current	30mA
Forward Current	10mA
Operating Temperature Range ⁽⁴⁾	
LM185-1.2-N	-55°C to +125°C
LM285-1.2-N	-40°C to +85°C
LM385-1.2-N	0°C to 70°C
ESD Susceptibility ⁽⁵⁾	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 Pkg.	
Vapor phase (60 sec.)	215°C
Infrared (15 sec.)	220°C
See AN-450 "Surface Mounting Methods and Their Effect on Product Reliability" for other methods of soldering surface mount devices.	

- (1) 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. For specifications and test conditions, see the Electrical Characteristics. The specifications apply only for the test conditions listed.
- (2) Refer to RETS185H-1.2 for military specifications.
- (3) If Military/Aerospace specified devices are required, please contact the TI Sales Office/Distributors for availability and specifications.
- (4) For elevated temperature operation, see [Table 1](#).
- (5) The human body model is a 100 pF capacitor discharged through a 1.5 kΩ resistor into each pin.

Table 1. $T_{J(max)}$ for Elevated Temperature Operation

DEVICE	$T_{J(max)}$ (°C)
LM185-1.2-N	150
LM285-1.2-N	125
LM385-1.2-N	100

ELECTRICAL CHARACTERISTICS⁽¹⁾

Parameter	Conditions	Typ	LM185-1.2-N LM185BX-1.2-N LM185BY-1.2-N LM285-1.2-N LM285BX-1.2-N LM285BY-1.2-N		LM385B-1.2-N LM385BX-1.2-N LM385BY-1.2-N		LM385-1.2-N		Units (Limit)
			Tested Limit ⁽²⁾ (⁽³⁾)	Design Limit ⁽⁴⁾	Tested Limit ⁽²⁾	Design Limit ⁽⁴⁾	Tested Limit ⁽²⁾	Design Limit ⁽⁴⁾	
Reverse Breakdown Voltage	$T_A = 25^\circ\text{C}$, $10\mu\text{A} \leq I_R \leq 20\text{mA}$	1.23 5	1.223		1.223		1.205		V(Min)
			1.247		1.247		1.260		V(Max)
Minimum Operating Current		8	10	20	15	20	15	20	μA
	LM385M3-1.2-N						10	15	(Max)
Reverse Breakdown Voltage Change with Current	$10\mu\text{A} \leq I_R \leq 1\text{mA}$		1	1.5	1	1.5	1	1.5	mV (Max)
	$1\text{mA} \leq I_R \leq 20\text{mA}$		10	20	20	25	20	25	mV (Max)
Reverse Dynamic Impedance	$I_R = 100\mu\text{A}$, $f = 20\text{Hz}$	1							Ω
Wideband Noise (rms)	$I_R = 100\mu\text{A}$, $10\text{Hz} \leq f \leq 10\text{kHz}$	60							μV
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 ⁽⁵⁾	$I_R = 100\mu\text{A}$ X Suffix Y Suffix All Others		30 50		30 50			150	ppm/ $^\circ\text{C}$ ppm/ $^\circ\text{C}$ ppm/ $^\circ\text{C}$ (Max)

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

(2) Production tested.

(3) A military RETS electrical specification is available on request.

(4) Specified by design. Not production tested. These limits are not used to calculate average outgoing quality levels.

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

THERMAL CHARACTERISTICS

Thermal Resistance	TO-92	TO	SOIC	SOT-23
θ_{JA} (junction to ambient)	180 $^\circ\text{C}/\text{W}$ (0.4" leads) 170 $^\circ\text{C}/\text{W}$ (0.125" leads)	440 $^\circ\text{C}/\text{W}$	165 $^\circ\text{C}/\text{W}$	283 $^\circ\text{C}/\text{W}$
θ_{JC} (junction to case)	N/A	80 $^\circ\text{C}/\text{W}$	N/A	N/A

TYPICAL PERFORMANCE CHARACTERISTICS

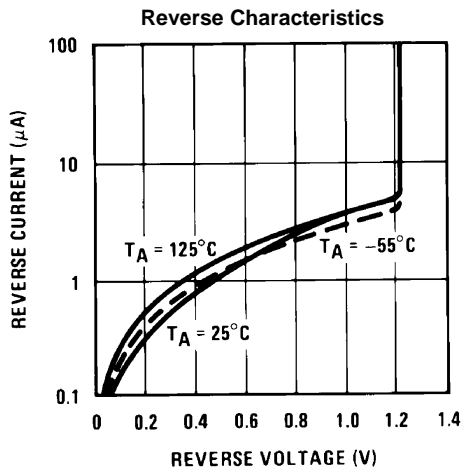


Figure 5.

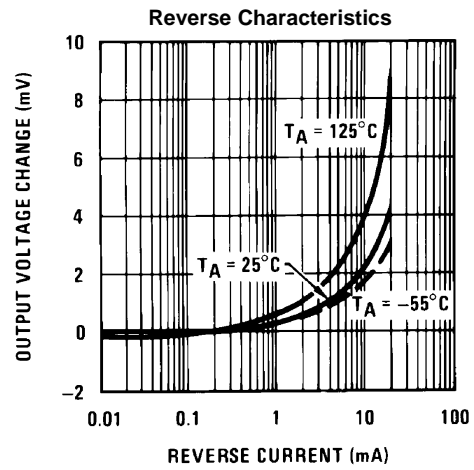


Figure 6.

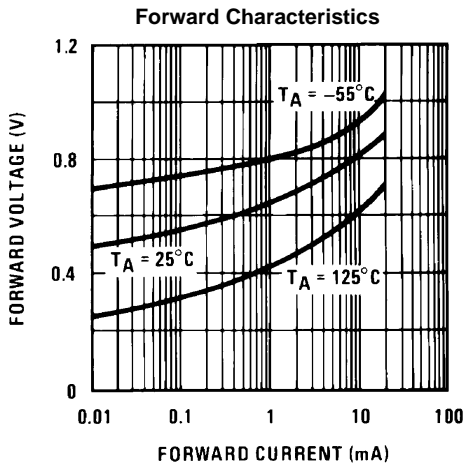


Figure 7.

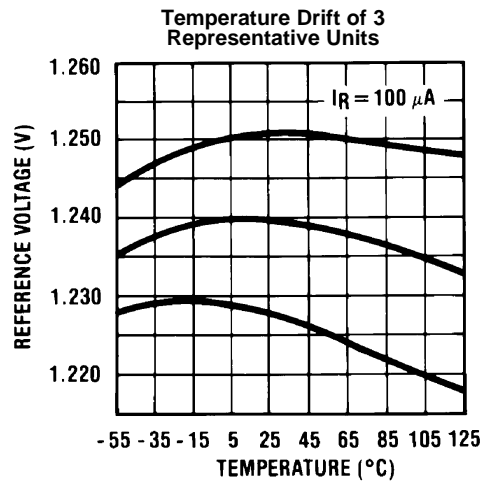


Figure 8.

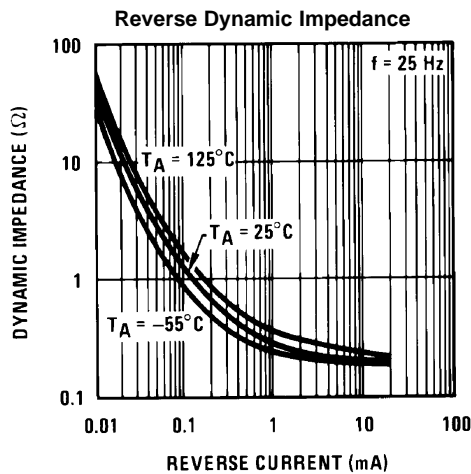


Figure 9.

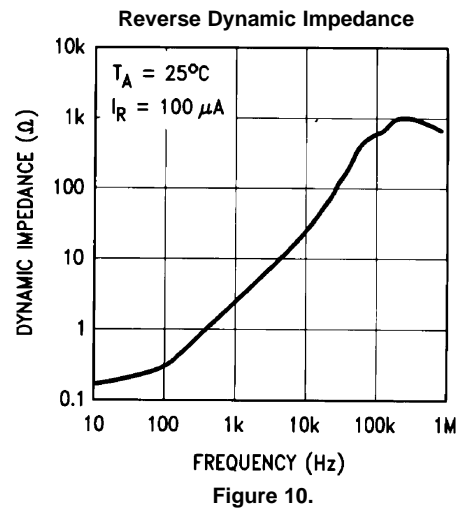


Figure 10.

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

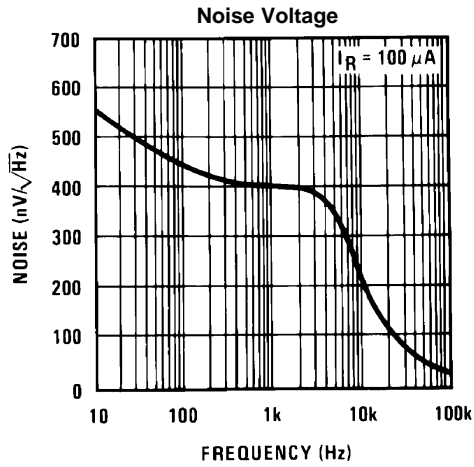


Figure 11.

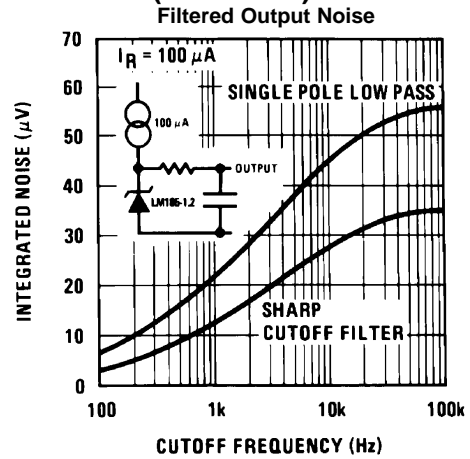


Figure 12.

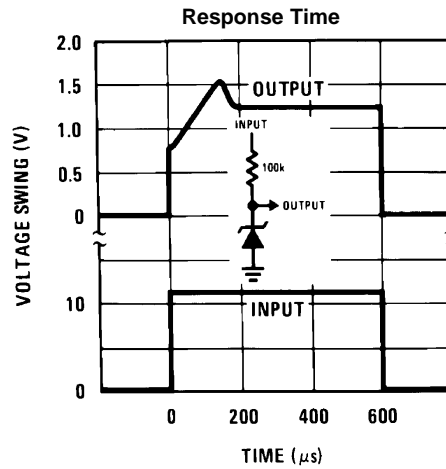


Figure 13.

TYPICAL APPLICATIONS

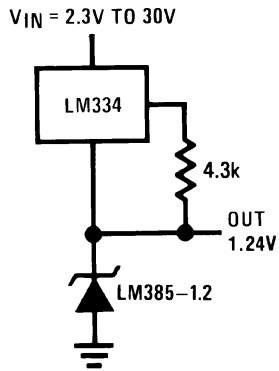


Figure 14. Wide Input Range Reference

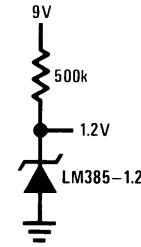


Figure 15. Micropower Reference from 9V Battery

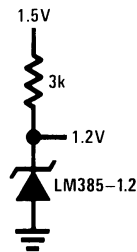
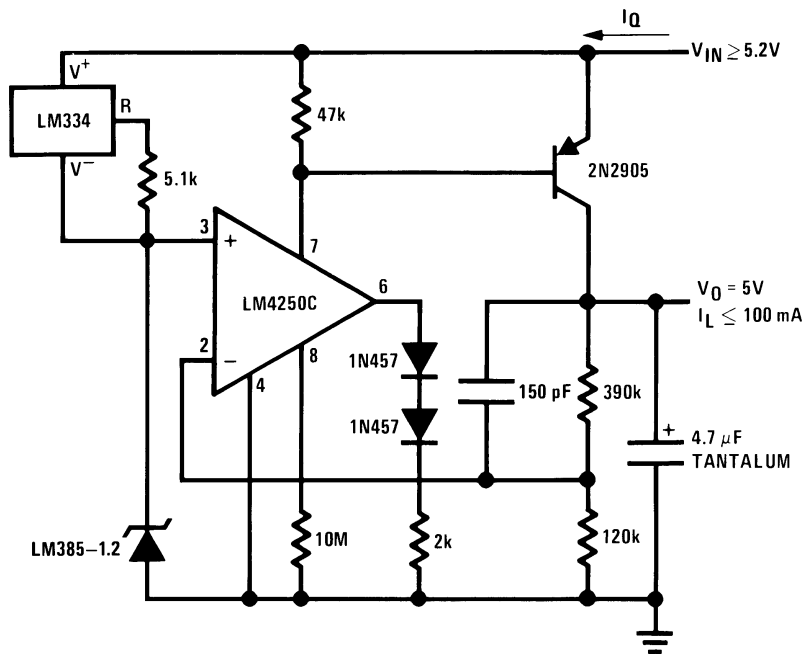
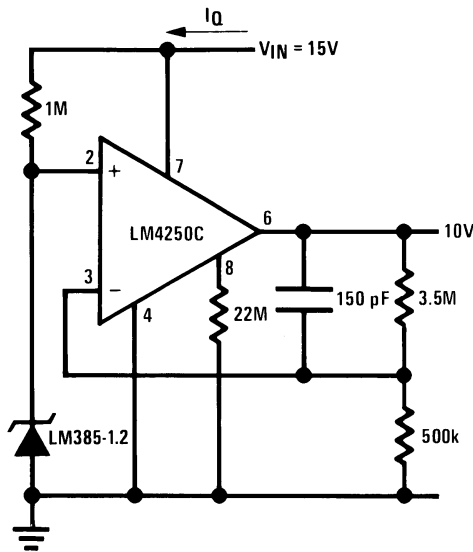


Figure 16. Reference from 1.5V Battery



* $I_Q \approx 30\mu A$

Figure 17. Micropower* 5V Regulator



* $I_Q \approx 20\mu\text{A}$ standby current

Figure 18. Micropower* 10V Reference

$$*I_{OUT} = \frac{1.23V}{R2}$$

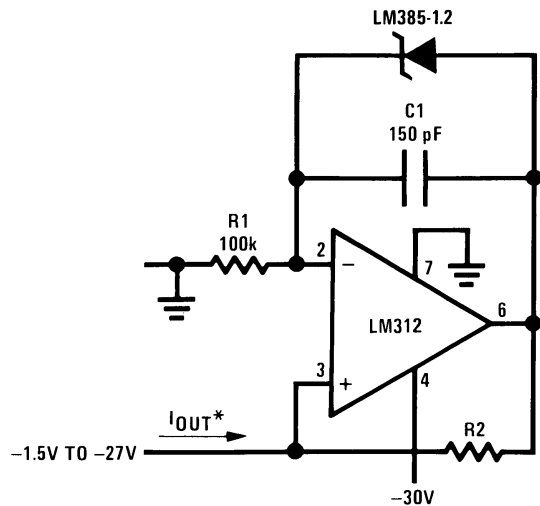


Figure 19.

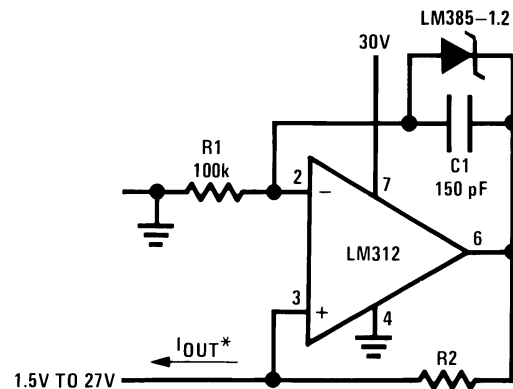
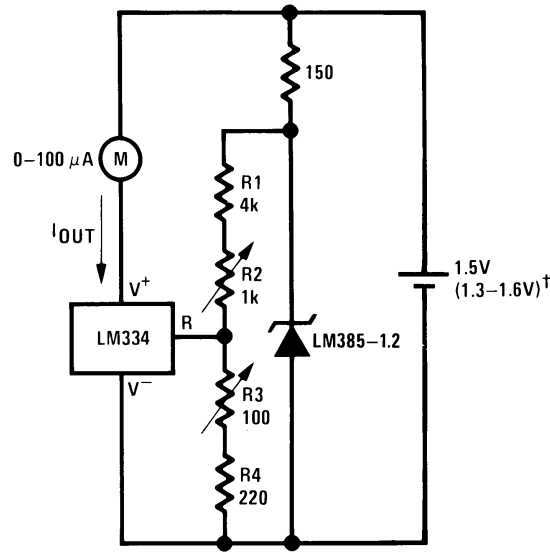


Figure 20. Precision 1μA to 1mA Current Sources

METER THERMOMETERS

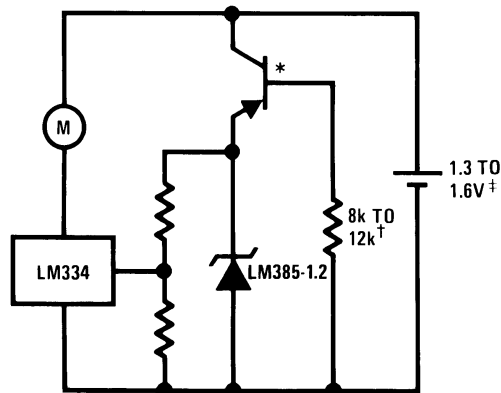


Calibration

1. Short LM385-1.2-N, adjust R3 for $I_{OUT} = \text{temp}$ at $1\mu\text{A}/^\circ\text{K}$
 2. Remove short, adjust R2 for correct reading in centigrade
- † I_Q at 1.3V=500μA
 I_Q at 1.6V=2.4mA

Figure 21. 0°C–100°C Thermometer

Figure 22.



*2N3638 or 2N2907 select for inverse $H_{FE} \approx 5$

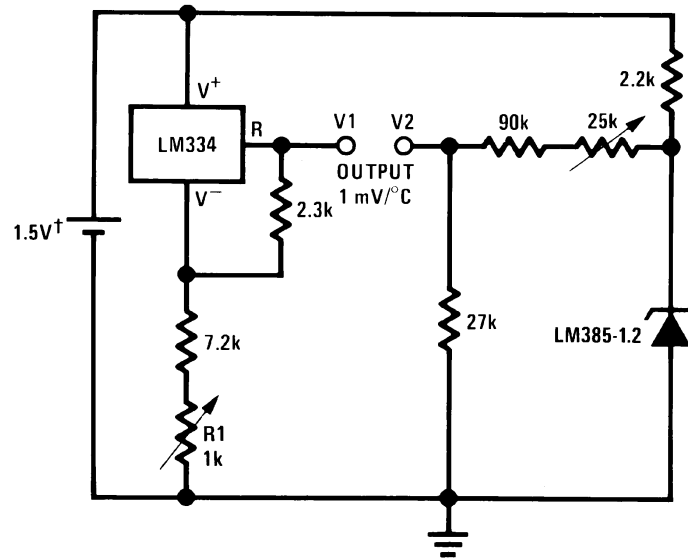
†Select for operation at 1.3V

‡ $I_Q \approx 600\mu\text{A}$ to $900\mu\text{A}$

Figure 23. Lower Power Thermometer

Thermocouple Type	Seebeck Coefficient ($\mu\text{V}/^\circ\text{C}$)	R1 (Ω)	R2 (Ω)	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 Ω	12.17	11.17
S	6.4	63.4	150 Ω	1.908	1.766

Typical supply current 50 μA

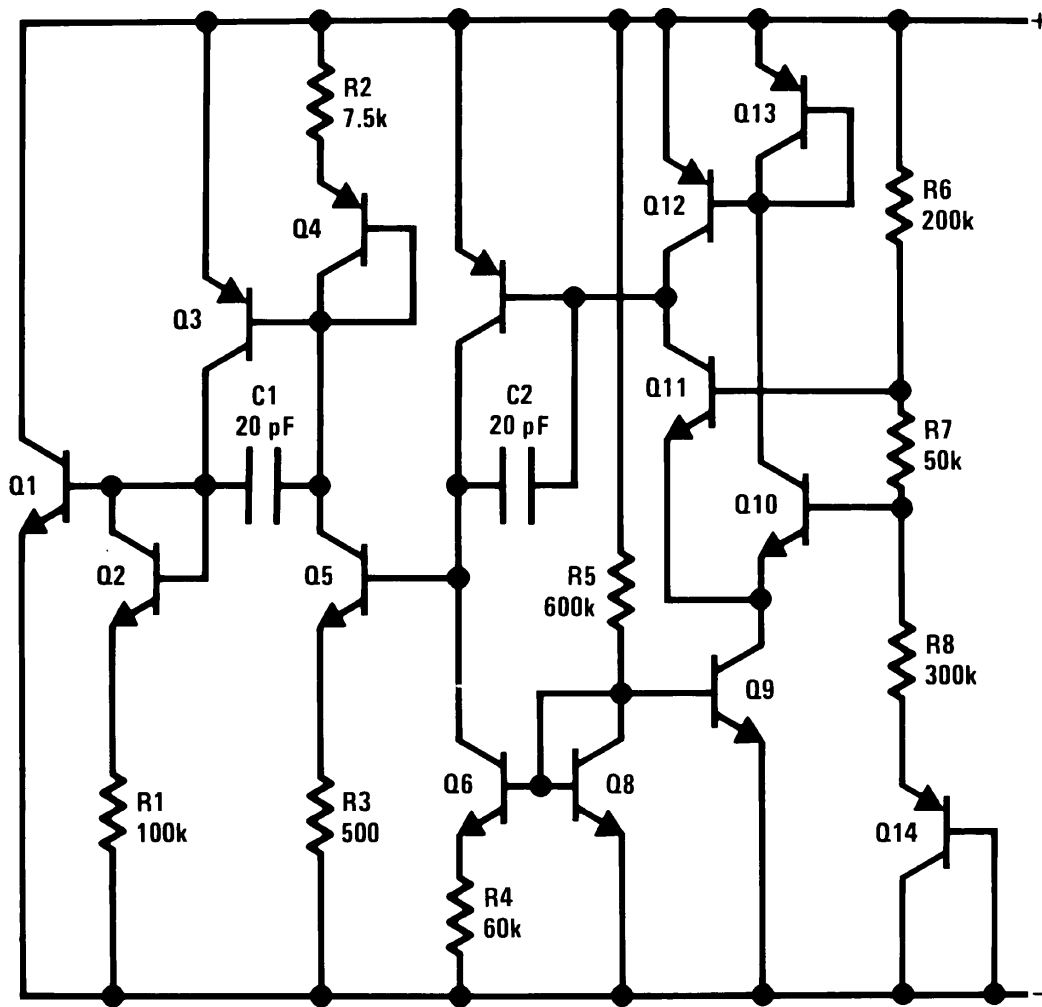


Calibration

1. Adjust R1 so that V1 = temp at 1mV/°K
 2. Adjust V2 to 273.2mV
- †I_Q for 1.3V to 1.6V battery voltage = 50 μA to 150 μA

Figure 26. Centigrade Thermometer

SCHEMATIC DIAGRAM



REVISION HISTORY

Changes from Revision D (April 2013) to Revision E	Page
• Changed layout of National Data Sheet to TI format	11

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
LM185BYH-1.2/NOPB	ACTIVE	TO	NDU	2	1000	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	-55 to 125	(LM185BYH1.2 ~ LM185BYH1.2)	Samples
LM185H-1.2/NOPB	ACTIVE	TO	NDU	2	1000	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	-55 to 125	(LM185H1.2 ~ LM185H1.2)	Samples
LM285BXM-1.2/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	285BX M1.2	Samples
LM285BXM-1.2/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	285BX M1.2	Samples
LM285BXZ-1.2/LFT4	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type		285BX Z-1.2	Samples
LM285BXZ-1.2/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	-40 to 85	285BX Z-1.2	Samples
LM285BYM-1.2/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	285BY M1.2	Samples
LM285BYM-1.2/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	285BY M1.2	Samples
LM285M-1.2/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM285 M1.2	Samples
LM285MX-1.2/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM285 M1.2	Samples
LM285Z-1.2/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	-40 to 85	LM28 5Z-1.2	Samples
LM385BM-1.2	NRND	SOIC	D	8	95	TBD	Call TI	Call TI	0 to 70	LM385 BM1.2	
LM385BM-1.2/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM385 BM1.2	Samples
LM385BMX-1.2	NRND	SOIC	D	8	2500	TBD	Call TI	Call TI	0 to 70	LM385 BM1.2	
LM385BMX-1.2/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM385 BM1.2	Samples
LM385BXM-1.2/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	385BX M1.2	Samples
LM385BXM-1.2/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	385BX M1.2	Samples

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
LM385BXZ-1.2/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	0 to 70	385BX Z-1.2	Samples
LM385BYM-1.2/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	385BY M1.2	Samples
LM385BYMX-1.2/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	385BY M1.2	Samples
LM385BYZ-1.2/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	0 to 70	385BY Z-1.2	Samples
LM385BZ-1.2/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	0 to 70	LM385 BZ1.2	Samples
LM385M-1.2	NRND	SOIC	D	8	95	TBD	Call TI	Call TI	0 to 70	LM385 M1.2	
LM385M-1.2/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM385 M1.2	Samples
LM385M3-1.2	NRND	SOT-23	DBZ	3	1000	TBD	Call TI	Call TI	0 to 70	R11	
LM385M3-1.2/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	R11	Samples
LM385M3X-1.2	NRND	SOT-23	DBZ	3	3000	TBD	Call TI	Call TI	0 to 70	R11	
LM385M3X-1.2/NOPB	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	R11	Samples
LM385MX-1.2/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM385 M1.2	Samples
LM385Z-1.2/LFT3	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type		LM385 Z-1.2	Samples
LM385Z-1.2/LFT4	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type		LM385 Z-1.2	Samples
LM385Z-1.2/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	0 to 70	LM385 Z-1.2	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.

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

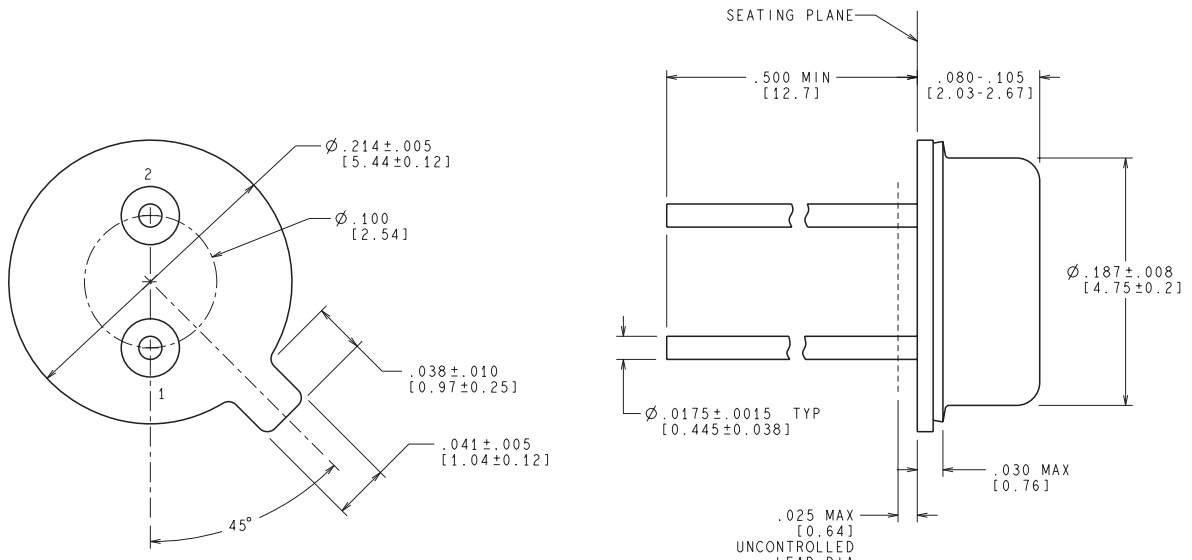
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM285BXM3-1.2/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM285BYMX-1.2/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM285MX-1.2/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM385BM3-1.2	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM385BM3-1.2/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM385BXM3-1.2/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM385BYMX-1.2/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM385M3-1.2	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM385M3-1.2/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM385M3X-1.2	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM385M3X-1.2/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM385MX-1.2/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)
LM285BXM3-1.2/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM285BYM3-1.2/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM285M3-1.2/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM385BM3-1.2	SOIC	D	8	2500	367.0	367.0	35.0
LM385BM3-1.2/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM385BXM3-1.2/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM385BYM3-1.2/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM385M3-1.2	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM385M3-1.2/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0
LM385M3X-1.2	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM385M3X-1.2/NOPB	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM385M3-1.2/NOPB	SOIC	D	8	2500	367.0	367.0	35.0

NDU0002A



CONTROLLING DIMENSION IS INCH
VALUES IN [] ARE MILLIMETERS

H02A (Rev F)

GENERIC PACKAGE VIEW

DBZ 3

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



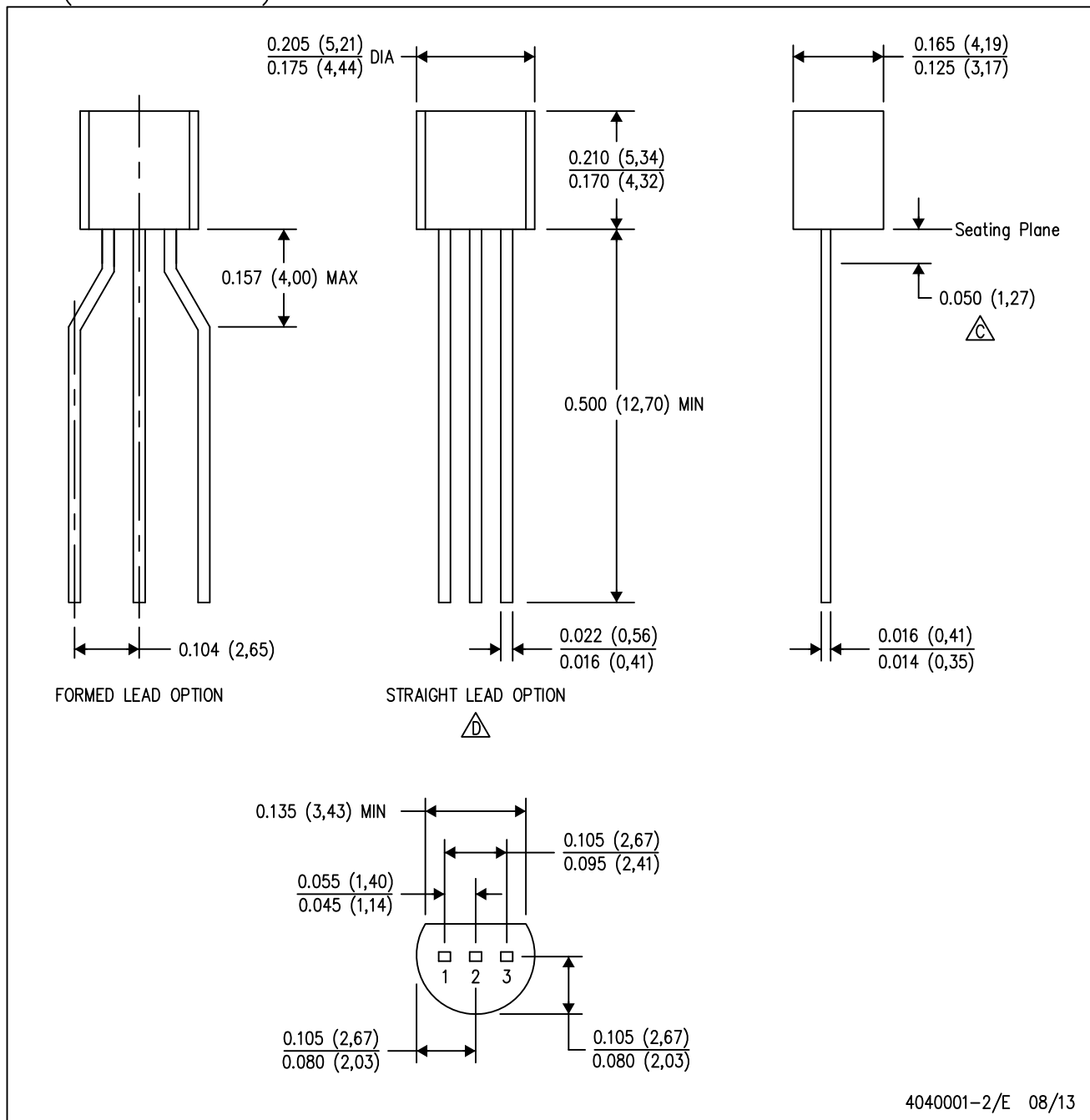
Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4203227/C

MECHANICAL DATA

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE

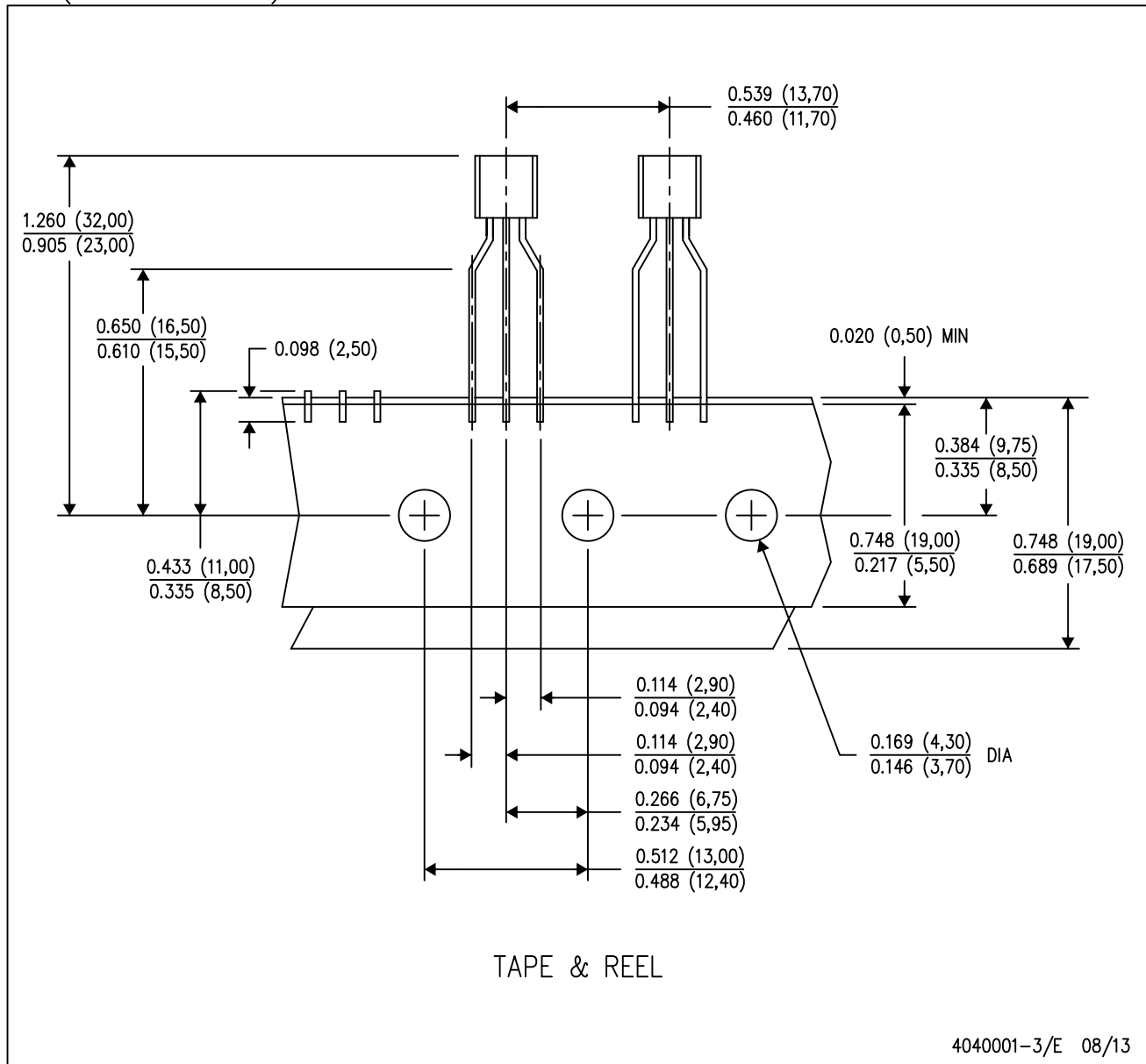


- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - (C) Lead dimensions are not controlled within this area.
 - (D) Falls within JEDEC TO-226 Variation AA (TO-226 replaces TO-92).
 - E. Shipping Method:
 Straight lead option available 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:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - 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.

IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated ("TI") technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources 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.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include; without limitation, TI's standard terms for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>), [evaluation modules](#), and [samples](http://www.ti.com/sc/docs/sampterm.htm) (<http://www.ti.com/sc/docs/sampterm.htm>).

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2017, Texas Instruments Incorporated