

## 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  $20\text{mA}$
- $1\Omega$  Dynamic Impedance
- Low Temperature Coefficient
- Low Voltage Reference— $1.235\text{V}$
- $2.5\text{V}$  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  $20\text{mA}$  current range, they feature exceptionally low dynamic impedance and good temperature stability. On-chip trimming is used to provide tight voltage tolerance. Since the LM185-1.2-N band-gap reference uses only transistors and resistors, low noise and good long term stability result.

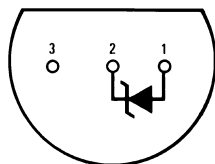
Careful design of the LM185-1.2-N has made the device exceptionally tolerant of capacitive loading, making it easy to use in almost any reference application. The wide dynamic operating range allows its use with widely varying supplies with excellent regulation.

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.

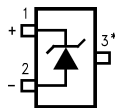
Further, the wide operating current allows it to replace older references with a tighter tolerance part.

The LM185-1.2-N is rated for operation over a  $-55^\circ\text{C}$  to  $125^\circ\text{C}$  temperature range while the LM285-1.2-N is rated  $-40^\circ\text{C}$  to  $85^\circ\text{C}$  and the LM385-1.2-N  $0^\circ\text{C}$  to  $70^\circ\text{C}$ . 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

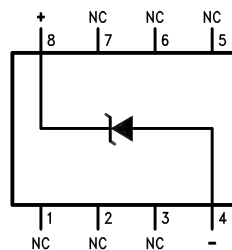


**Figure 1. T0-92 Package (LP)  
(Bottom View)**

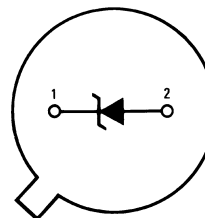


\* Pin 3 is attached to the Die Attach Pad (DAP) and should be connected to Pin 2 or left floating.

**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.

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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                                                                                                                     | 30mA            |
| Forward Current                                                                                                                     | 10mA            |
| Operating Temperature Range <sup>(4)</sup>                                                                                          |                 |
| 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 <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 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<sup>(1)</sup>**

| Parameter                                      | Conditions                                                                                        | Typ       | LM185-1.2-N<br>LM185BX-1.2-N<br>LM185BY-1.2-N<br>LM285-1.2-N<br>LM285BX-1.2-N<br>LM285BY-1.2-N |                             | LM385B-1.2-N<br>LM385BX-1.2-N<br>LM385BY-1.2-N |                             | LM385-1.2-N                 |                             | Units<br>(Limit)               |
|------------------------------------------------|---------------------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------------------------|
|                                                |                                                                                                   |           | Tested Limit <sup>(2)</sup><br>(3)                                                             | Design Limit <sup>(4)</sup> | Tested Limit <sup>(2)</sup>                    | Design Limit <sup>(4)</sup> | Tested Limit <sup>(2)</sup> | Design Limit <sup>(4)</sup> |                                |
| Reverse Breakdown Voltage                      | $T_A = 25^\circ\text{C}$ ,<br>$10\mu\text{A} \leq I_R \leq 20\text{mA}$                           | 1.23<br>5 | 1.223<br>1.247                                                                                 |                             | 1.223<br>1.247                                 |                             | 1.205<br>1.260              |                             | V(Min)<br>V(Max)               |
| Minimum Operating Current                      |                                                                                                   | 8         | 10                                                                                             | <b>20</b>                   | 15                                             | <b>20</b>                   | 15                          | <b>20</b>                   | $\mu\text{A}$                  |
|                                                | LM385M3-1.2-N                                                                                     |           |                                                                                                |                             |                                                |                             | 10                          | <b>15</b>                   | (Max)                          |
| Reverse Breakdown Voltage Change with Current  | $10\mu\text{A} \leq I_R \leq 1\text{mA}$                                                          |           | 1                                                                                              | <b>1.5</b>                  | 1                                              | <b>1.5</b>                  | 1                           | <b>1.5</b>                  | mV<br>(Max)                    |
|                                                | $1\text{mA} \leq I_R \leq 20\text{mA}$                                                            |           | 10                                                                                             | <b>20</b>                   | 20                                             | <b>25</b>                   | 20                          | <b>25</b>                   | mV<br>(Max)                    |
| Reverse Dynamic Impedance                      | $I_R = 100\mu\text{A}$ , $f = 20\text{Hz}$                                                        | 1         |                                                                                                |                             |                                                |                             |                             |                             | $\Omega$                       |
| Wideband Noise (rms)                           | $I_R = 100\mu\text{A}$ ,<br>$10\text{Hz} \leq f \leq 10\text{kHz}$                                | 60        |                                                                                                |                             |                                                |                             |                             |                             | $\mu\text{V}$                  |
| Long Term Stability                            | $I_R = 100\mu\text{A}$ , $T = 1000\text{ Hr}$ ,<br>$T_A = 25^\circ\text{C} \pm 0.1^\circ\text{C}$ | 20        |                                                                                                |                             |                                                |                             |                             |                             | ppm                            |
| Average Temperature Coefficient <sup>(5)</sup> | $I_R = 100\mu\text{A}$                                                                            |           |                                                                                                |                             |                                                |                             |                             |                             |                                |
|                                                | X Suffix                                                                                          |           | <b>30</b>                                                                                      |                             | <b>30</b>                                      |                             |                             |                             | ppm/ $^\circ\text{C}$          |
|                                                | Y Suffix                                                                                          |           | <b>50</b>                                                                                      |                             | <b>50</b>                                      |                             |                             |                             | ppm/ $^\circ\text{C}$          |
|                                                | All Others                                                                                        |           |                                                                                                | <b>150</b>                  |                                                | <b>150</b>                  |                             | <b>150</b>                  | ppm/ $^\circ\text{C}$<br>(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  $T_{\text{MAX}}$  and  $T_{\text{MIN}}$ , divided by  $T_{\text{MAX}} - T_{\text{MIN}}$ . The measured temperatures are  $-55^\circ\text{C}$ ,  $-40^\circ\text{C}$ ,  $0^\circ\text{C}$ ,  $25^\circ\text{C}$ ,  $70^\circ\text{C}$ ,  $85^\circ\text{C}$ ,  $125^\circ\text{C}$ .

**THERMAL CHARACTERISTICS**

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

## TYPICAL PERFORMANCE CHARACTERISTICS

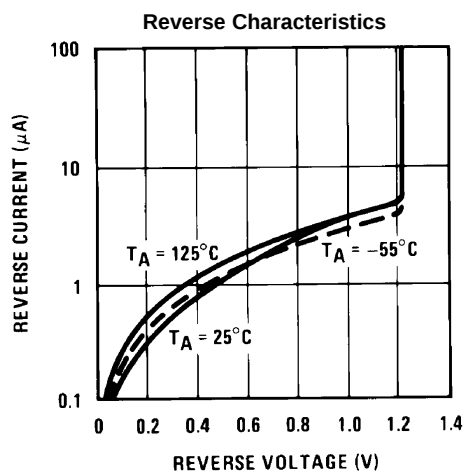


Figure 5.

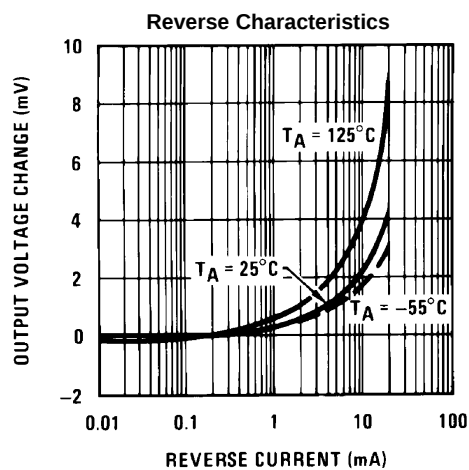


Figure 6.

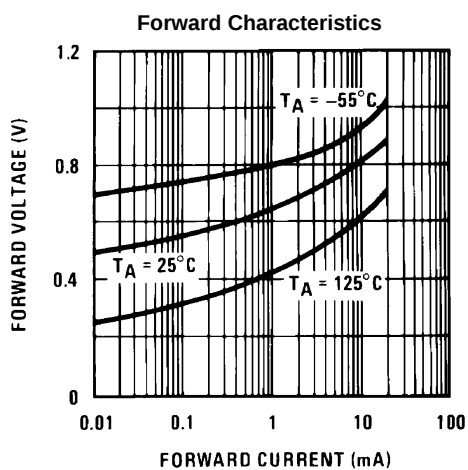


Figure 7.

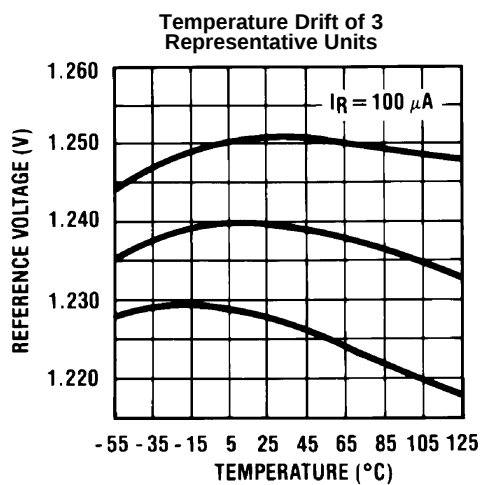


Figure 8.

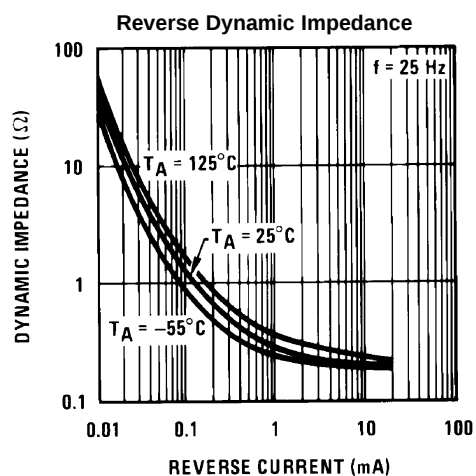


Figure 9.

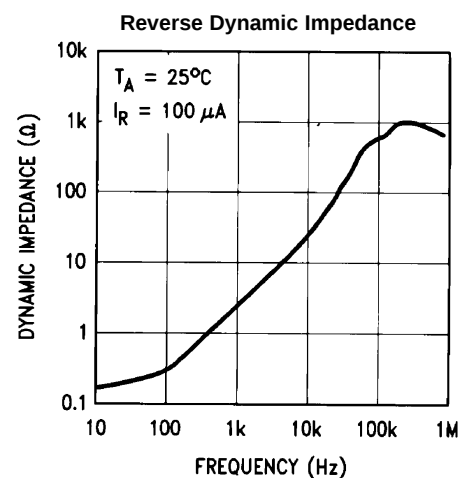


Figure 10.

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

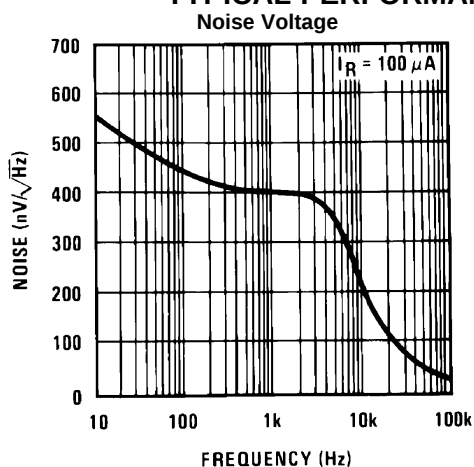


Figure 11.

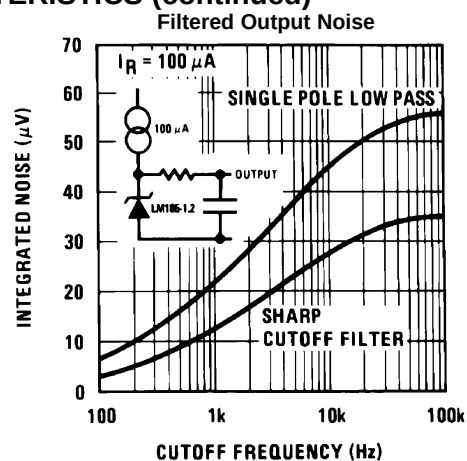


Figure 12.

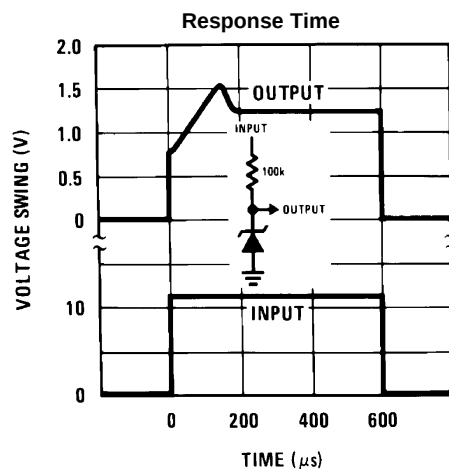


Figure 13.

## TYPICAL APPLICATIONS

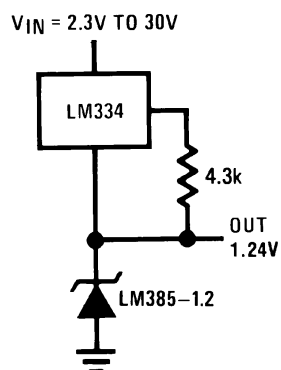


Figure 14. Wide Input Range Reference

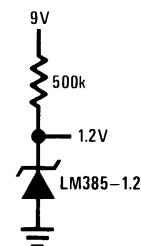


Figure 15. Micropower Reference from 9V Battery

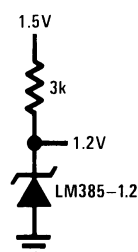


Figure 16. Reference from 1.5V Battery

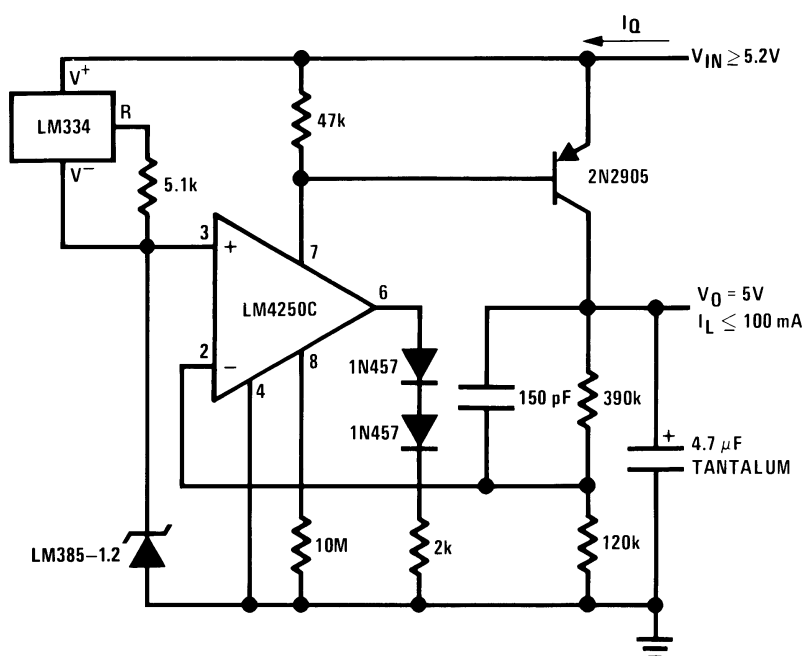
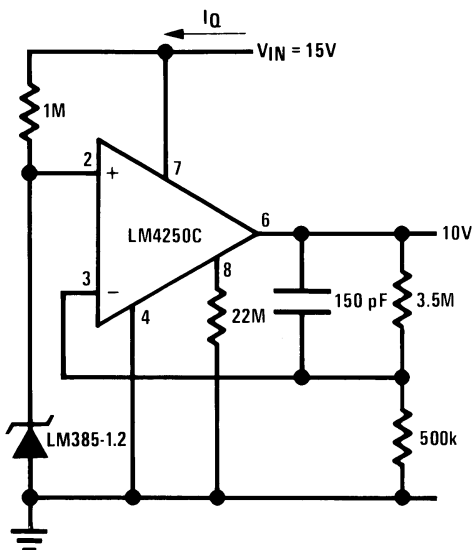
\* $I_Q \approx 30\mu A$ 

Figure 17. Micropower\* 5V Regulator



\* $I_Q \approx 20\mu A$  standby current

Figure 18. Micropower\* 10V Reference

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

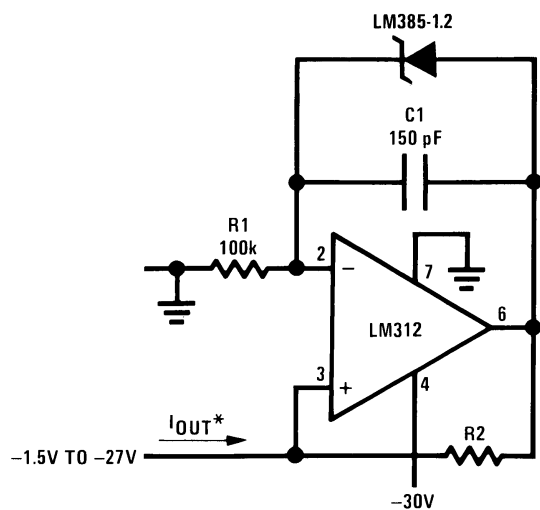


Figure 19.

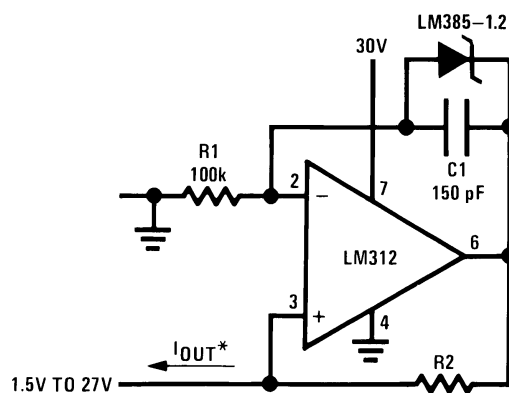
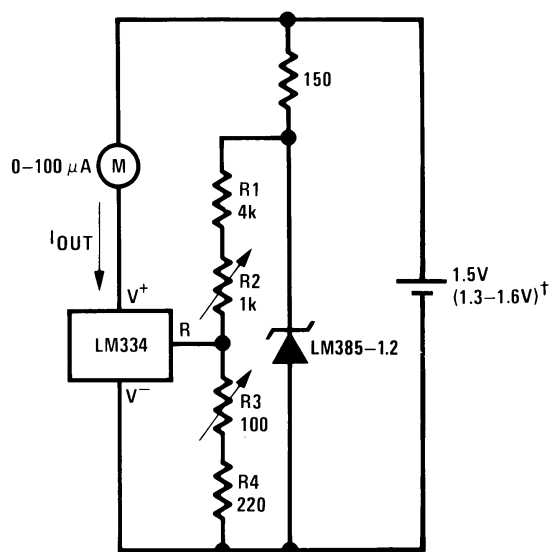
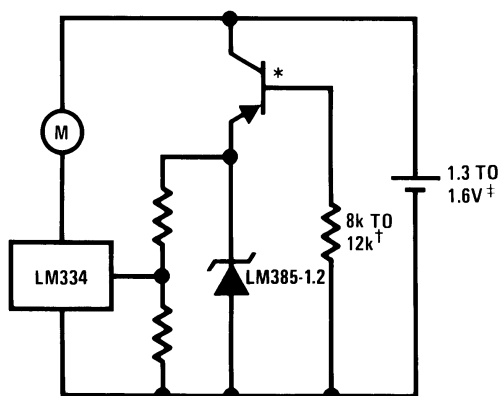


Figure 20. Precision 1μA to 1mA Current Sources

**METER THERMOMETERS****Calibration**

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

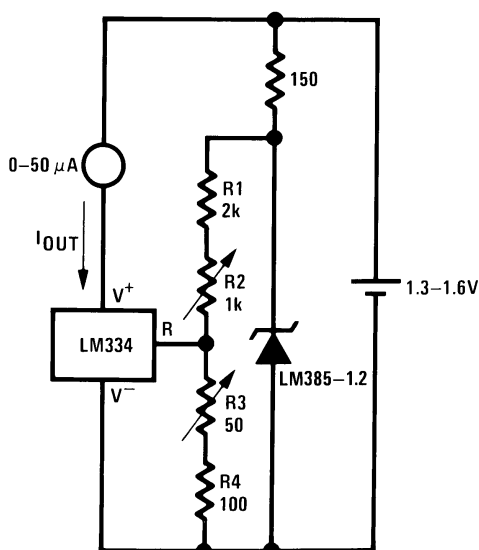
**Figure 21. 0°C–100°C Thermometer****Figure 22.**

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

†Select for operation at 1.3V

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

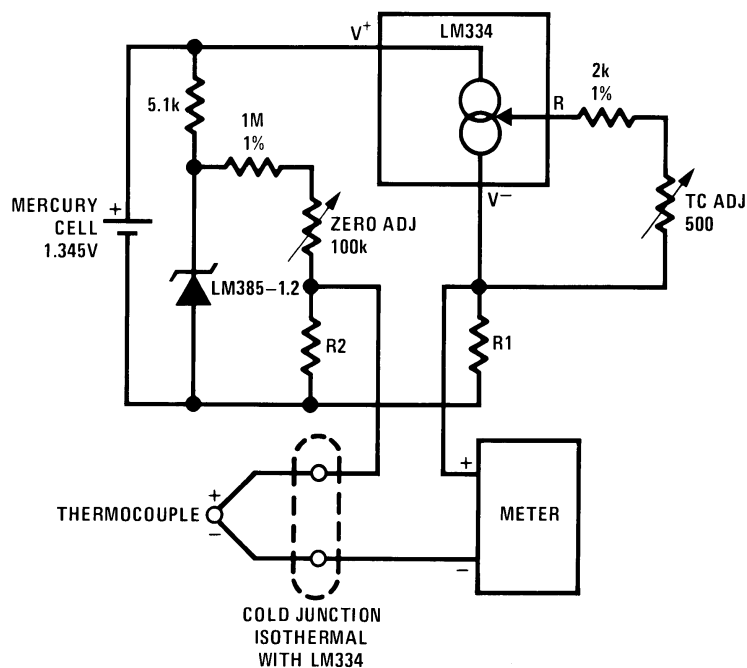
**Figure 23. Lower Power Thermometer**



## Calibration

1. Short LM385-1.2-N, adjust R3 for  $I_{OUT} = \text{temp}$  at  $1.8\mu A/^{\circ}K$
2. Remove short, adjust R2 for correct reading in  $^{\circ}F$

**Figure 24. 0°F–50°F Thermometer**



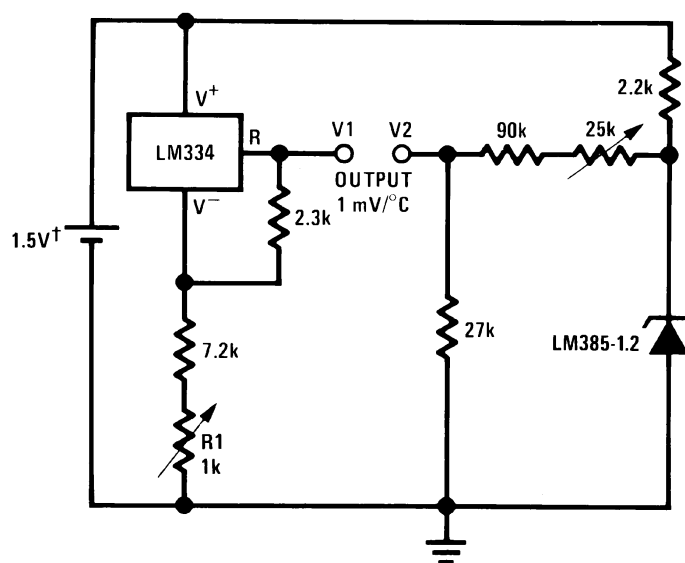
### Adjustment Procedure

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 25. Micropower Thermocouple Cold Junction Compensator**

| Thermocouple | Seebeck     | R1   | R2    | Voltage   | Voltage   |
|--------------|-------------|------|-------|-----------|-----------|
| Type         | Coefficient | (Ω)  | (Ω)   | Across R1 | Across R2 |
|              | (μV/°C)     |      |       | @ 25°C    | (mV)      |
|              |             |      |       | (mV)      |           |
| J            | 52.3        | 523  | 1.24k | 15.60     | 14.32     |
| T            | 42.8        | 432  | 1k    | 12.77     | 11.78     |
| K            | 40.8        | 412  | 953Ω  | 12.17     | 11.17     |
| S            | 6.4         | 63.4 | 150Ω  | 1.908     | 1.766     |

Typical supply current 50µA

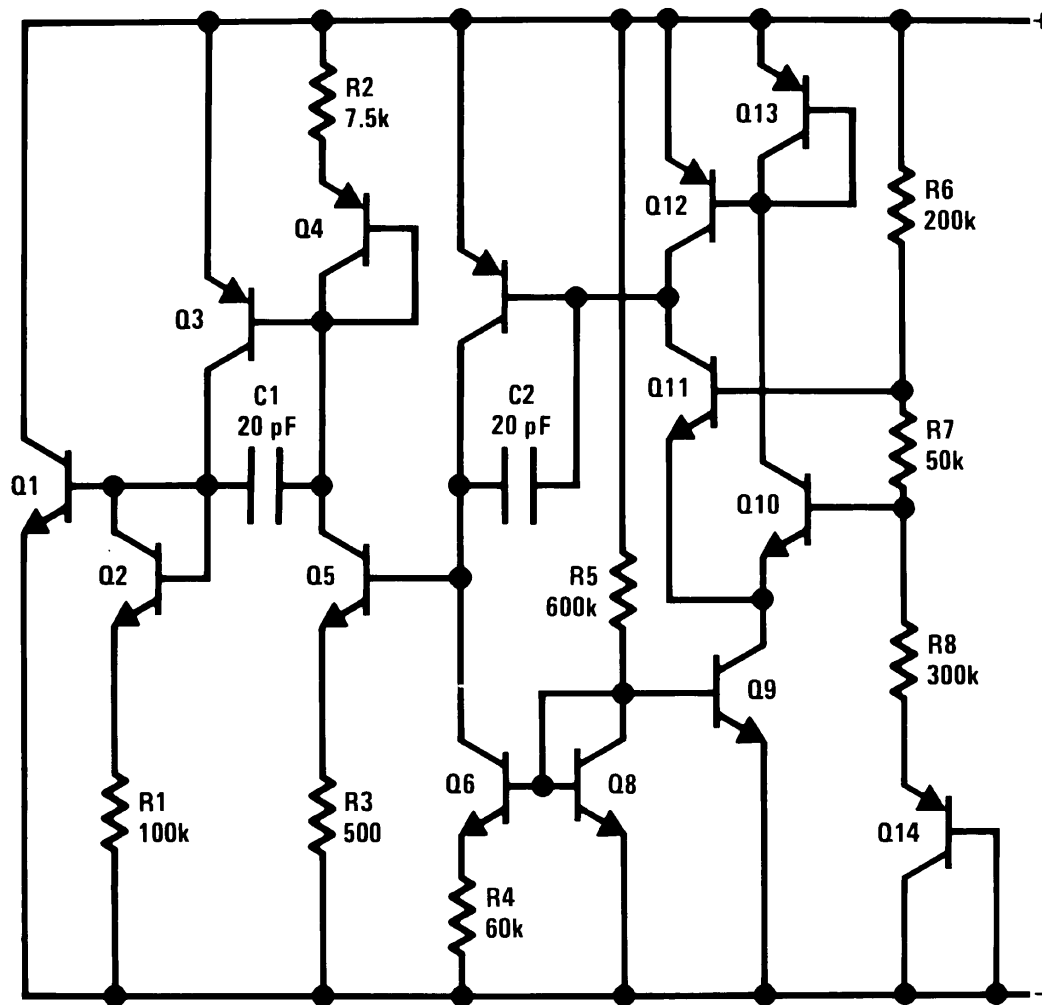


## Calibration

1. Adjust R1 so that  $V_1 = \text{temp}$  at  $1\text{mV}/^\circ\text{K}$
  2. Adjust V2 to  $273.2\text{mV}$
- $I_Q$  for 1.3V to 1.6V battery voltage =  $50\mu\text{A}$  to  $150\mu\text{A}$

**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 ..... | <a href="#">11</a> |

**PACKAGING INFORMATION**

| Orderable Device   | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|--------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| LM185BYH-1.2       | ACTIVE        | TO           | NDU                | 2    | 1000           | TBD                        | Call TI                 | Call TI              | -55 to 125   | LM185BYH1.2             | <a href="#">Samples</a> |
| LM185BYH-1.2/NOPB  | ACTIVE        | TO           | NDU                | 2    | 1000           | Green (RoHS<br>& no Sb/Br) | POST-PLATE              | Level-1-NA-UNLIM     | -55 to 125   | LM185BYH1.2             | <a href="#">Samples</a> |
| LM185H-1.2         | ACTIVE        | TO           | NDU                | 2    | 1000           | TBD                        | Call TI                 | Call TI              | -55 to 125   | LM185H1.2               | <a href="#">Samples</a> |
| LM185H-1.2/NOPB    | ACTIVE        | TO           | NDU                | 2    | 1000           | Green (RoHS<br>& no Sb/Br) | POST-PLATE              | Level-1-NA-UNLIM     | -55 to 125   | LM185H1.2               | <a href="#">Samples</a> |
| LM285BXM-1.2/NOPB  | ACTIVE        | SOIC         | D                  | 8    | 95             | Green (RoHS<br>& no Sb/Br) | CU SN                   | Level-1-260C-UNLIM   | -40 to 85    | 285BX<br>M1.2           | <a href="#">Samples</a> |
| LM285BXM-1.2/NOPB  | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | Level-1-260C-UNLIM   | -40 to 85    | 285BX<br>M1.2           | <a href="#">Samples</a> |
| LM285BXZ-1.2/LFT4  | ACTIVE        | TO-92        | LP                 | 3    | 2000           | Green (RoHS<br>& no Sb/Br) | CU SN                   | N / A for Pkg Type   |              | 285BX<br>Z-1.2          | <a href="#">Samples</a> |
| LM285BXZ-1.2/NOPB  | ACTIVE        | TO-92        | LP                 | 3    | 1800           | Green (RoHS<br>& no Sb/Br) | CU SN                   | N / A for Pkg Type   | -40 to 85    | 285BX<br>Z-1.2          | <a href="#">Samples</a> |
| LM285BYM-1.2/NOPB  | ACTIVE        | SOIC         | D                  | 8    | 95             | Green (RoHS<br>& no Sb/Br) | CU SN                   | Level-1-260C-UNLIM   | -40 to 85    | 285BY<br>M1.2           | <a href="#">Samples</a> |
| LM285BYMX-1.2/NOPB | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | Level-1-260C-UNLIM   | -40 to 85    | 285BY<br>M1.2           | <a href="#">Samples</a> |
| LM285H-1.2         | ACTIVE        | TO           | NDU                | 2    | 1000           | TBD                        | Call TI                 | Call TI              | -40 to 85    | LM285H1.2               | <a href="#">Samples</a> |
| LM285H-1.2/NOPB    | ACTIVE        | TO           | NDU                | 2    | 1000           | Green (RoHS<br>& no Sb/Br) | POST-PLATE              | Level-1-NA-UNLIM     | -40 to 85    | LM285H1.2               | <a href="#">Samples</a> |
| LM285M-1.2/NOPB    | ACTIVE        | SOIC         | D                  | 8    | 95             | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | Level-1-260C-UNLIM   | -40 to 85    | LM285<br>M1.2           | <a href="#">Samples</a> |
| LM285MX-1.2/NOPB   | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | Level-1-260C-UNLIM   | -40 to 85    | LM285<br>M1.2           | <a href="#">Samples</a> |
| LM285Z-1.2/NOPB    | ACTIVE        | TO-92        | LP                 | 3    | 1800           | Green (RoHS<br>& no Sb/Br) | CU SN                   | N / A for Pkg Type   | -40 to 85    | LM28<br>5Z-1.2          | <a href="#">Samples</a> |
| LM385BM-1.2        | NRND          | SOIC         | D                  | 8    | 95             | TBD                        | Call TI                 | Call TI              | 0 to 70      | LM385<br>BM1.2          |                         |
| LM385BM-1.2/NOPB   | ACTIVE        | SOIC         | D                  | 8    | 95             | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | Level-1-260C-UNLIM   | 0 to 70      | LM385<br>BM1.2          | <a href="#">Samples</a> |
| LM385BMX-1.2       | NRND          | SOIC         | D                  | 8    | 2500           | TBD                        | Call TI                 | Call TI              | 0 to 70      | LM385                   |                         |

| Orderable Device   | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|--------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
|                    |               |              |                    |      |                |                            |                         |                      |              | BM1.2                   |                         |
| LM385BMX-1.2/NOPB  | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | Level-1-260C-UNLIM   | 0 to 70      | LM385<br>BM1.2          | <a href="#">Samples</a> |
| LM385BXM-1.2/NOPB  | ACTIVE        | SOIC         | D                  | 8    | 95             | Green (RoHS<br>& no Sb/Br) | CU SN                   | Level-1-260C-UNLIM   | 0 to 70      | 385BX<br>M1.2           | <a href="#">Samples</a> |
| LM385BXM-1.2/NOPB  | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | Level-1-260C-UNLIM   | 0 to 70      | 385BX<br>M1.2           | <a href="#">Samples</a> |
| LM385BXZ-1.2/NOPB  | ACTIVE        | TO-92        | LP                 | 3    | 1800           | Green (RoHS<br>& no Sb/Br) | CU SN                   | N / A for Pkg Type   | 0 to 70      | 385BX<br>Z-1.2          | <a href="#">Samples</a> |
| LM385BYM-1.2/NOPB  | ACTIVE        | SOIC         | D                  | 8    | 95             | Green (RoHS<br>& no Sb/Br) | CU SN                   | Level-1-260C-UNLIM   | 0 to 70      | 385BY<br>M1.2           | <a href="#">Samples</a> |
| LM385BYMX-1.2      | NRND          | SOIC         | D                  | 8    | 2500           | TBD                        | Call TI                 | Call TI              | 0 to 70      | 385BY<br>M1.2           |                         |
| LM385BYMX-1.2/NOPB | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | Level-1-260C-UNLIM   | 0 to 70      | 385BY<br>M1.2           | <a href="#">Samples</a> |
| LM385BYZ-1.2/NOPB  | ACTIVE        | TO-92        | LP                 | 3    | 1800           | Green (RoHS<br>& no Sb/Br) | CU SN                   | N / A for Pkg Type   | 0 to 70      | 385BY<br>Z-1.2          | <a href="#">Samples</a> |
| LM385BZ-1.2/NOPB   | ACTIVE        | TO-92        | LP                 | 3    | 1800           | Green (RoHS<br>& no Sb/Br) | CU SN                   | N / A for Pkg Type   | 0 to 70      | LM385<br>BZ1.2          | <a href="#">Samples</a> |
| LM385M-1.2         | NRND          | SOIC         | D                  | 8    | 95             | TBD                        | Call TI                 | Call TI              | 0 to 70      | LM385<br>M1.2           |                         |
| LM385M-1.2/NOPB    | ACTIVE        | SOIC         | D                  | 8    | 95             | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | Level-1-260C-UNLIM   | 0 to 70      | LM385<br>M1.2           | <a href="#">Samples</a> |
| 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<br>& no Sb/Br) | CU SN                   | Level-1-260C-UNLIM   | 0 to 70      | R11                     | <a href="#">Samples</a> |
| 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<br>& no Sb/Br) | CU SN                   | Level-1-260C-UNLIM   | 0 to 70      | R11                     | <a href="#">Samples</a> |
| LM385MX-1.2        | NRND          | SOIC         | D                  | 8    | 2500           | TBD                        | Call TI                 | Call TI              | 0 to 70      | LM385<br>M1.2           |                         |
| LM385MX-1.2/NOPB   | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | Level-1-260C-UNLIM   | 0 to 70      | LM385<br>M1.2           | <a href="#">Samples</a> |
| LM385Z-1.2/LFT3    | ACTIVE        | TO-92        | LP                 | 3    | 2000           | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | N / A for Pkg Type   |              | LM385<br>Z-1.2          | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| LM385Z-1.2/LFT4  | ACTIVE        | TO-92        | LP                 | 3    | 2000           | Green (RoHS<br>& no Sb/Br) | SN   CU SN              | N / A for Pkg Type   |              | LM385<br>Z-1.2          | <a href="#">Samples</a> |
| LM385Z-1.2/NOPB  | ACTIVE        | TO-92        | LP                 | 3    | 1800           | Green (RoHS<br>& no Sb/Br) | CU SN                   | N / A for Pkg Type   | 0 to 70      | LM385<br>Z-1.2          | <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.

**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) 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.

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**TAPE AND REEL INFORMATION**


\*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-1.2/NOPB | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.5     | 5.4     | 2.0     | 8.0     | 12.0   | Q1            |
| LM285BYM-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            |
| LM385BM-1.2       | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.5     | 5.4     | 2.0     | 8.0     | 12.0   | Q1            |
| LM385BM-1.2/NOPB  | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.5     | 5.4     | 2.0     | 8.0     | 12.0   | Q1            |
| LM385BXM-1.2/NOPB | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.5     | 5.4     | 2.0     | 8.0     | 12.0   | Q1            |
| LM385BYM-1.2      | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.5     | 5.4     | 2.0     | 8.0     | 12.0   | Q1            |
| LM385BYM-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       | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.5     | 5.4     | 2.0     | 8.0     | 12.0   | Q1            |
| LM385MX-1.2/NOPB  | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.5     | 5.4     | 2.0     | 8.0     | 12.0   | Q1            |

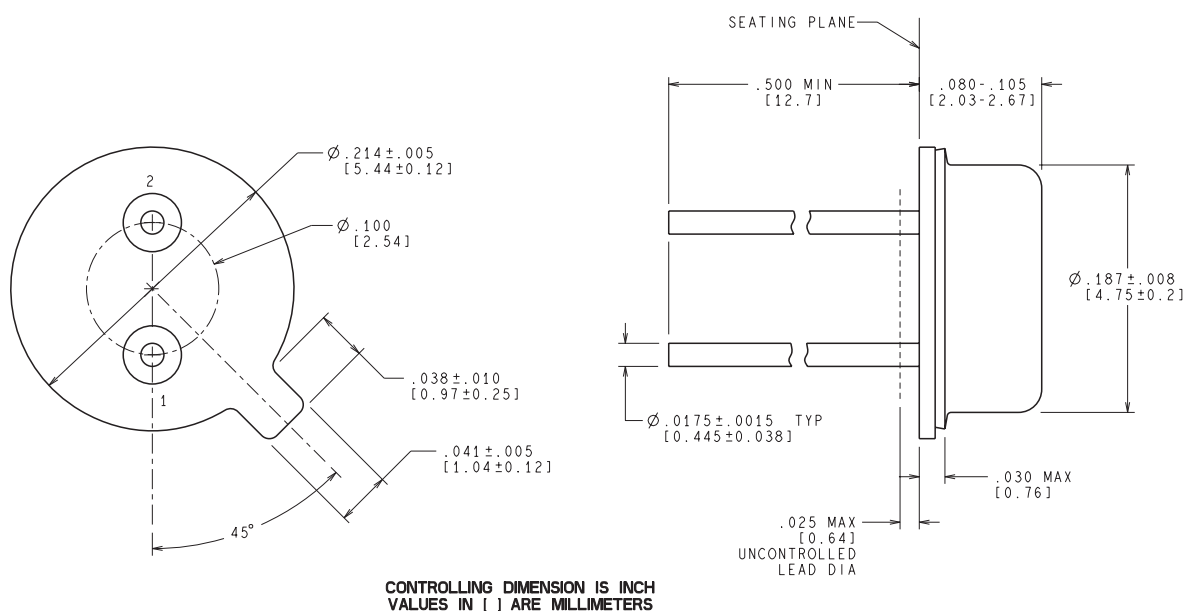
## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device            | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM285BXM-1.2/NOPB | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| LM285BYM-1.2/NOPB | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| LM285MX-1.2/NOPB  | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| LM385BM-1.2       | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| LM385BM-1.2/NOPB  | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| LM385BXM-1.2/NOPB | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| LM385BYM-1.2      | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| LM385BYM-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        |
| LM385MX-1.2       | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| LM385MX-1.2/NOPB  | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |

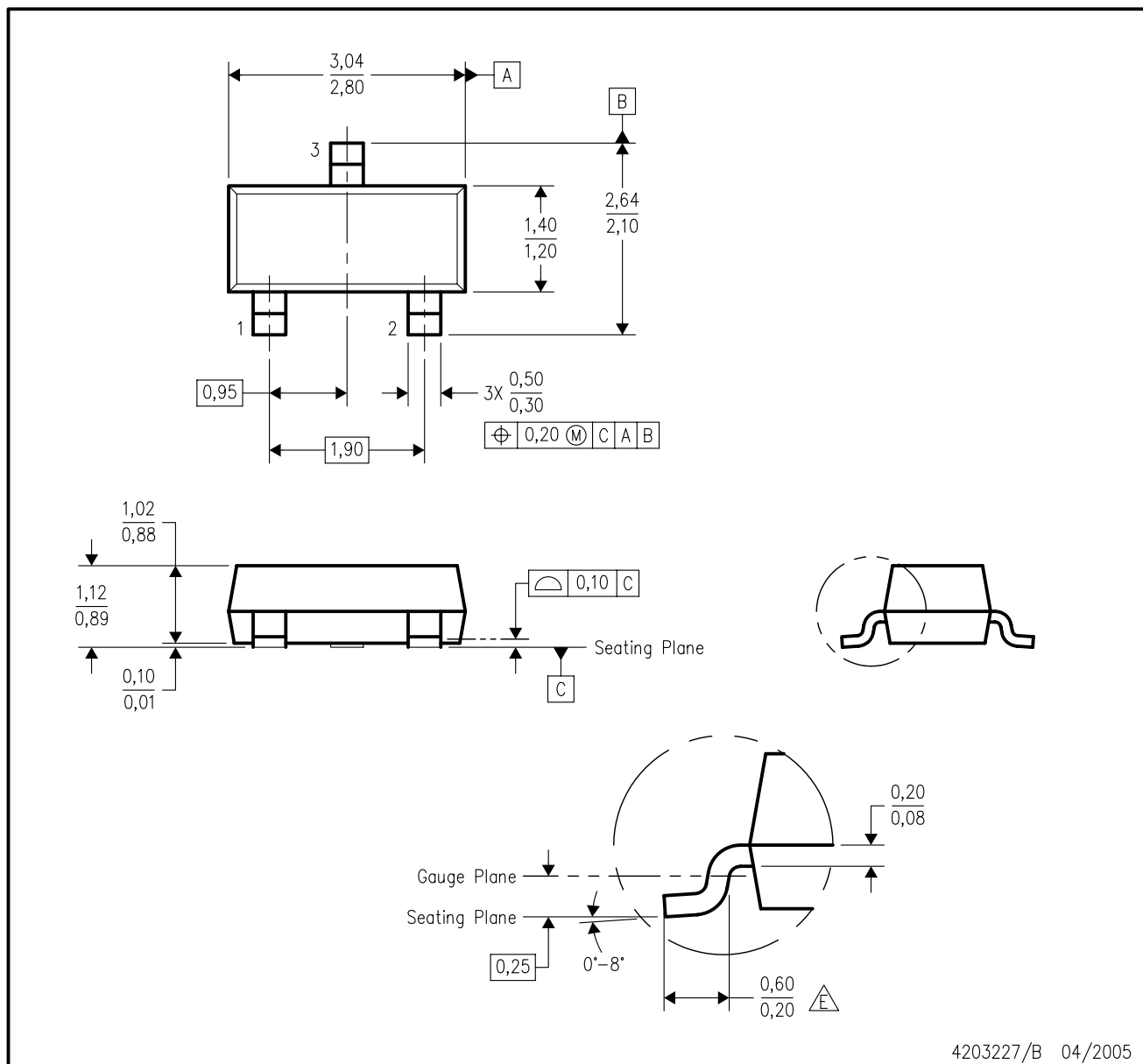
NDU0002A



H02A (Rev F)

DBZ (R-PDSO-G3)

PLASTIC SMALL-OUTLINE



4203227/B 04/2005

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.

D (R-PDSO-G8)

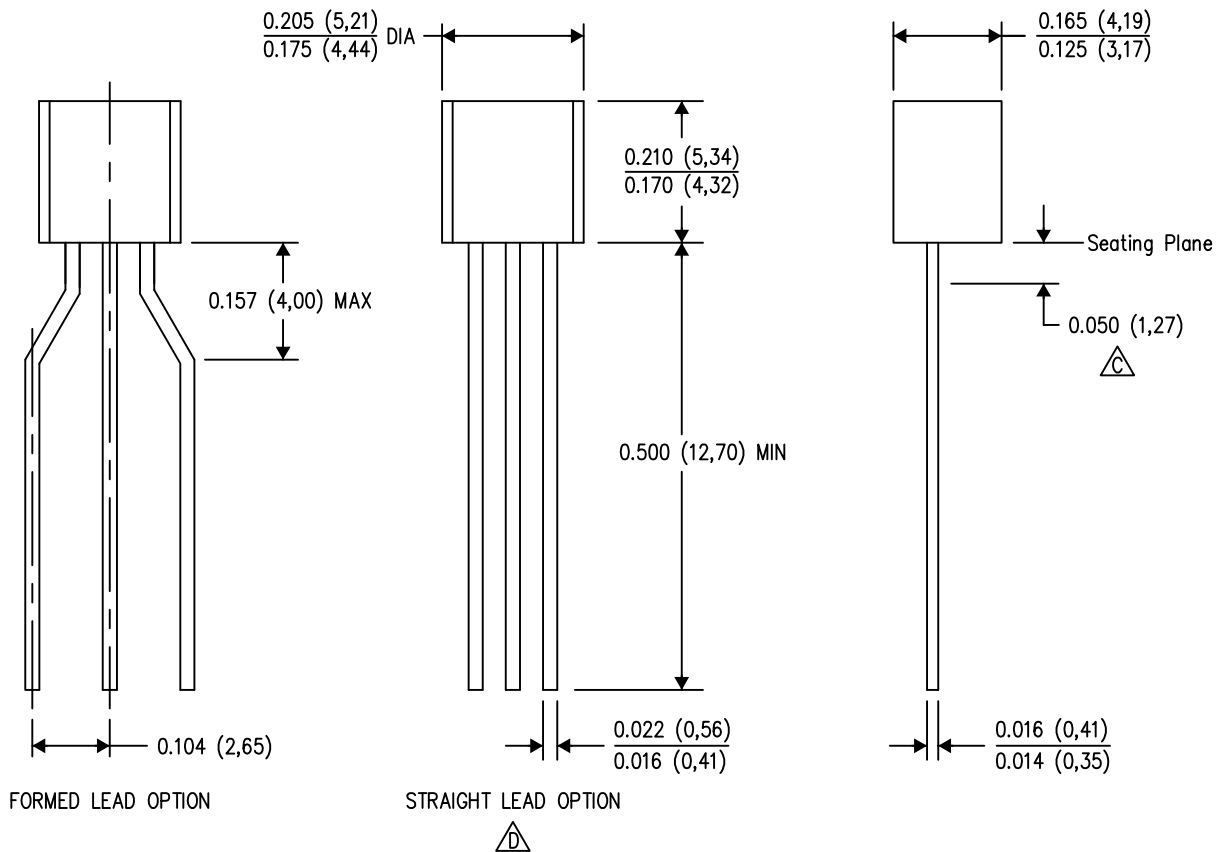
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  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.
  - $\triangle D$  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.

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE

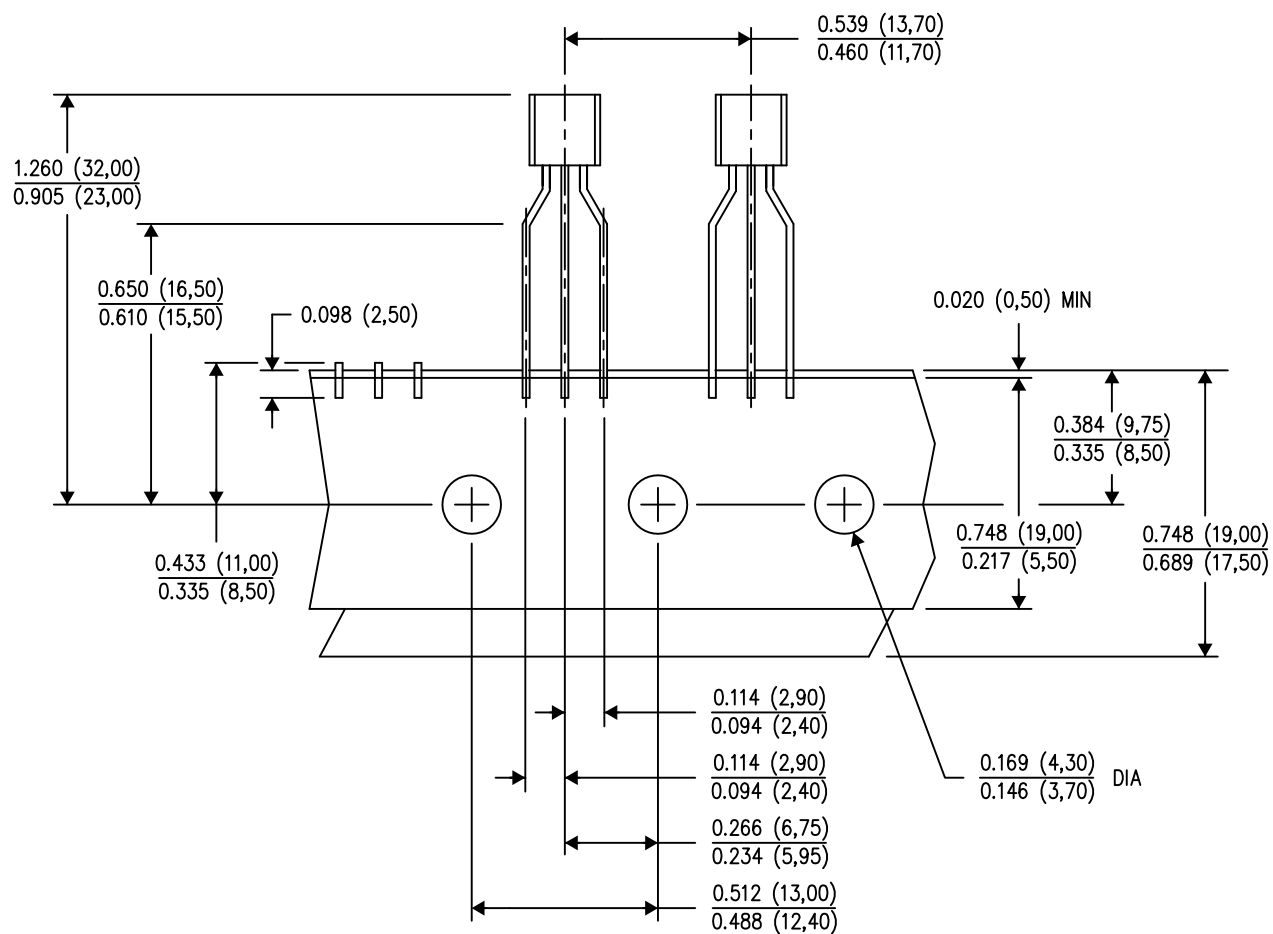


4040001-2/E 08/13

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - 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.

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



TAPE &amp; REEL

4040001-3/E 08/13

- 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.

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| Clocks and Timers            | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>                             |
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| 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

|                               |                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------|
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| 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>                             |
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