

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

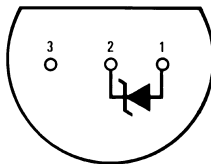
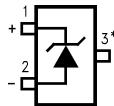


Figure 1. T0-92 Package (LP)
(Bottom View)



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

Figure 2. SOT-23

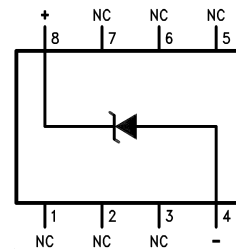


Figure 3. SOIC Package

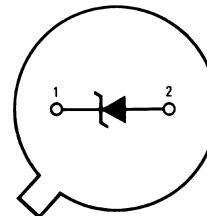


Figure 4. TO Package (NDV)
(Bottom View)



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 ⁽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

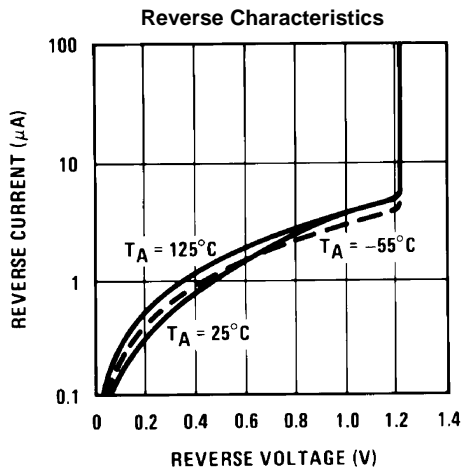


Figure 5.

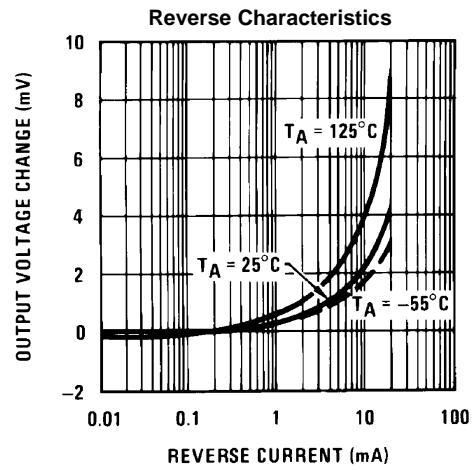


Figure 6.

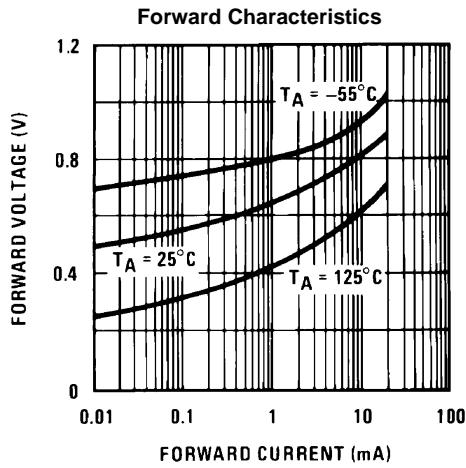


Figure 7.

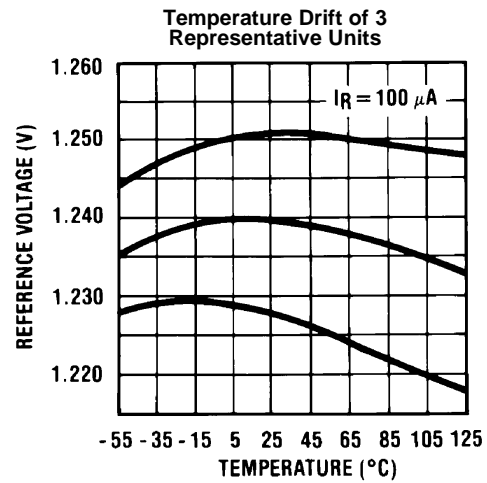


Figure 8.

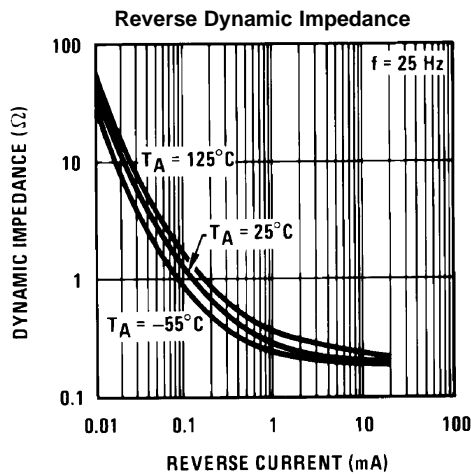


Figure 9.

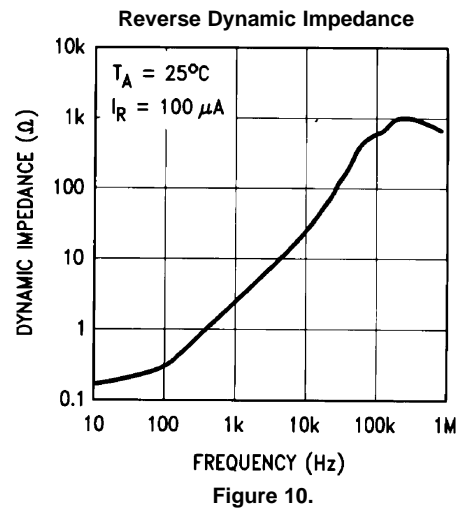
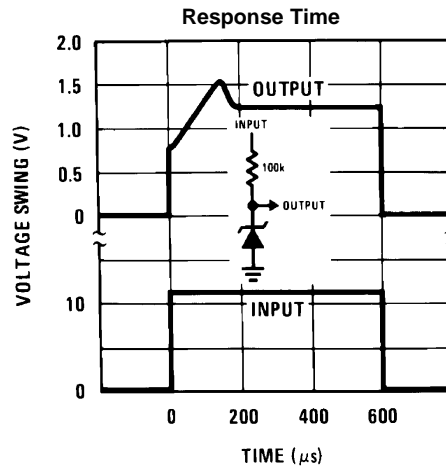
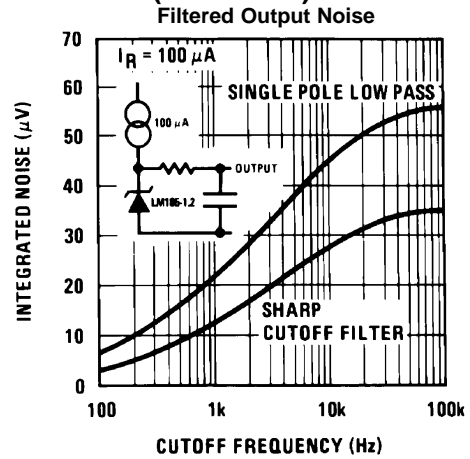
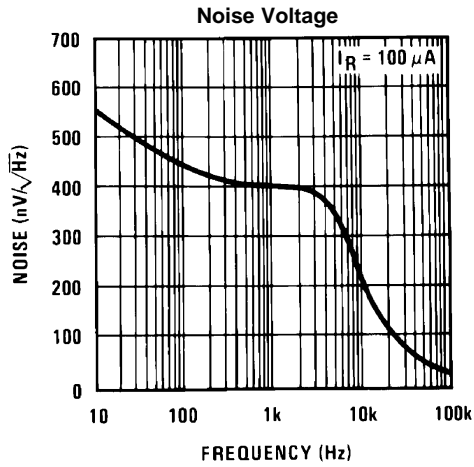


Figure 10.

TYPICAL PERFORMANCE CHARACTERISTICS (continued)



TYPICAL APPLICATIONS

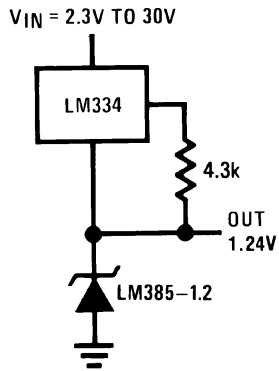


Figure 14. Wide Input Range Reference

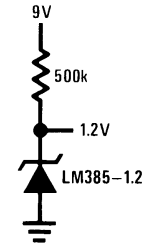


Figure 15. Micropower Reference from 9V Battery

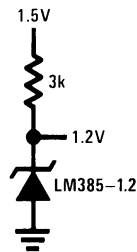
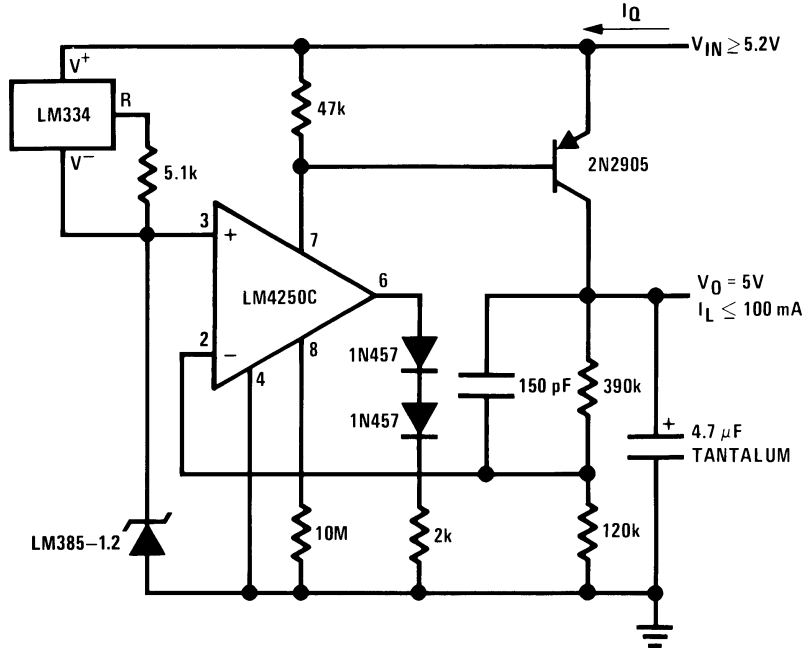
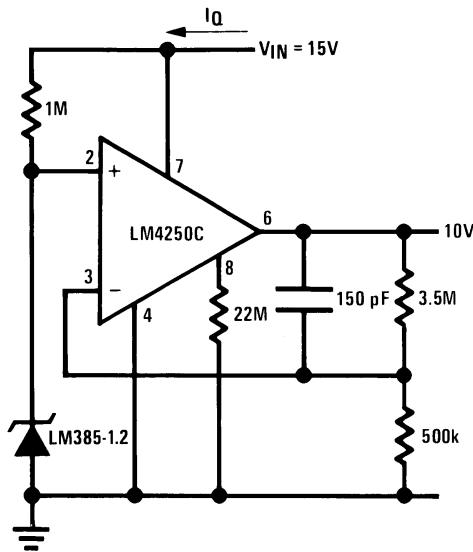


Figure 16. Reference from 1.5V Battery



* $I_Q \approx 30\mu A$

Figure 17. Micropower* 5V Regulator



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

Figure 18. Micropower* 10V Reference

$$*I_{OUT} = \frac{1.23\text{V}}{R_2}$$

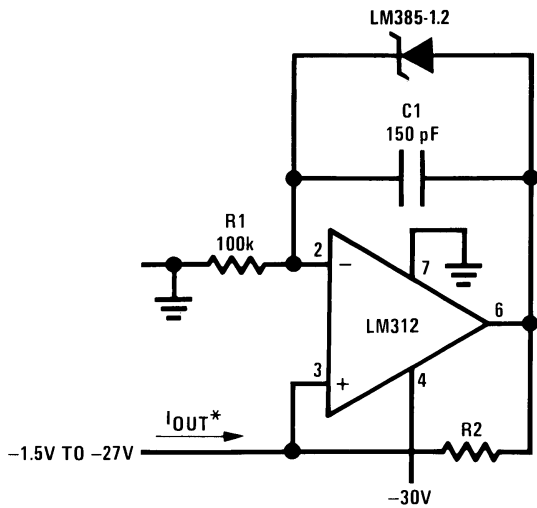


Figure 19.

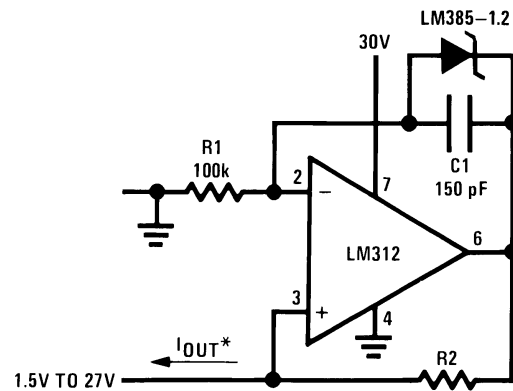
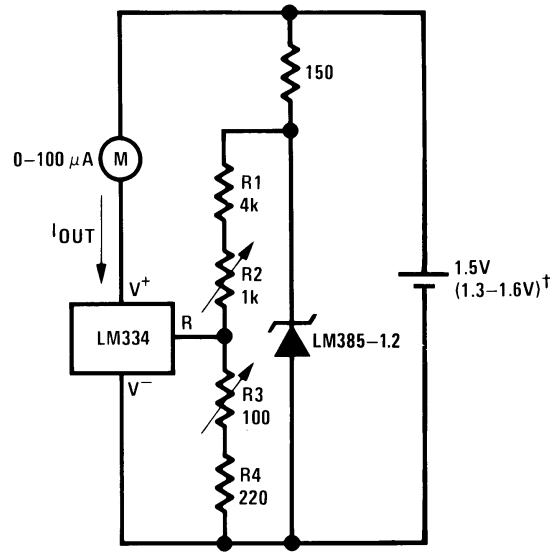


Figure 20. Precision 1μA to 1mA Current Sources

METER THERMOMETERS

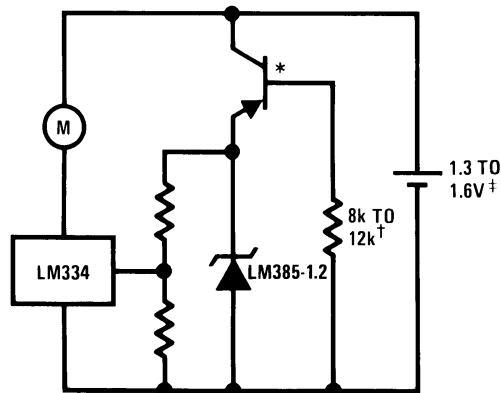


Calibration

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 = $500\mu\text{A}$
 I_Q at 1.6V = 2.4mA

Figure 21. 0°C–100°C Thermometer

Figure 22.

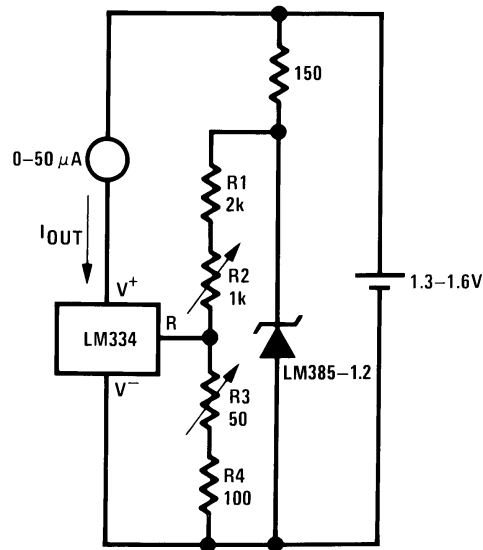


*2N3638 or 2N2907 select for inverse $H_{FE} \approx 5$

†Select for operation at 1.3V

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

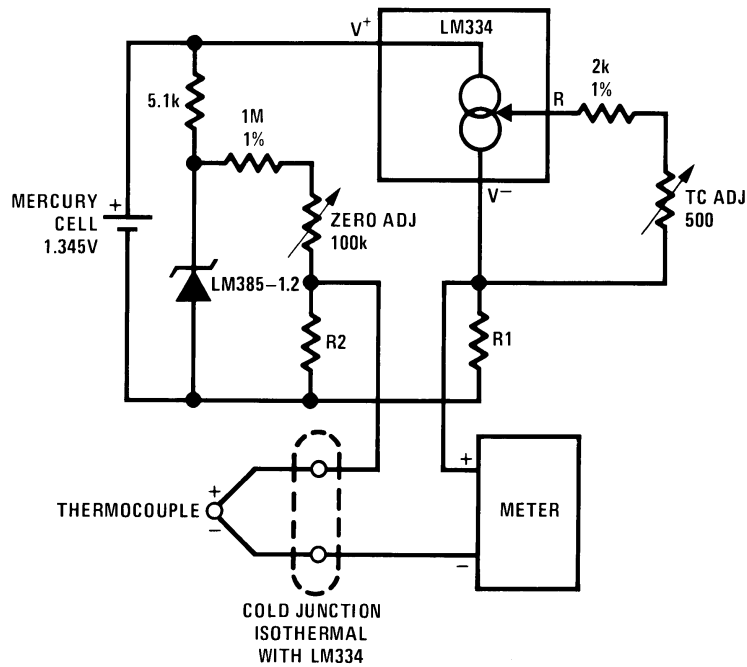
Figure 23. Lower Power Thermometer



Calibration

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

Figure 24. 0°F–50°F Thermometer



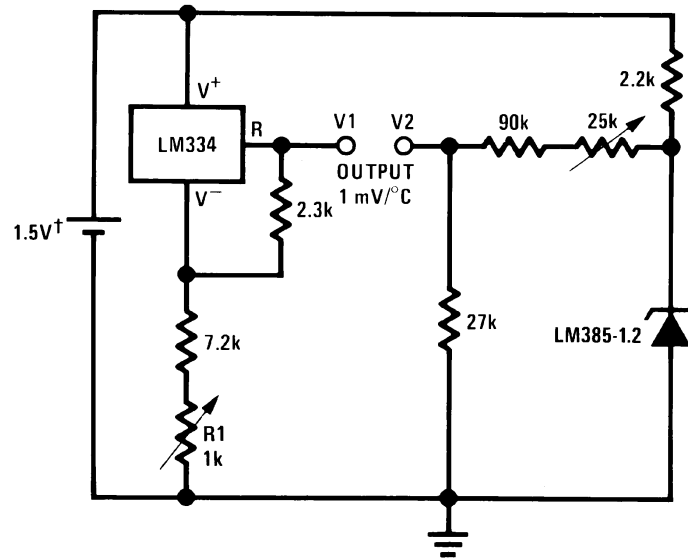
Adjustment Procedure

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 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

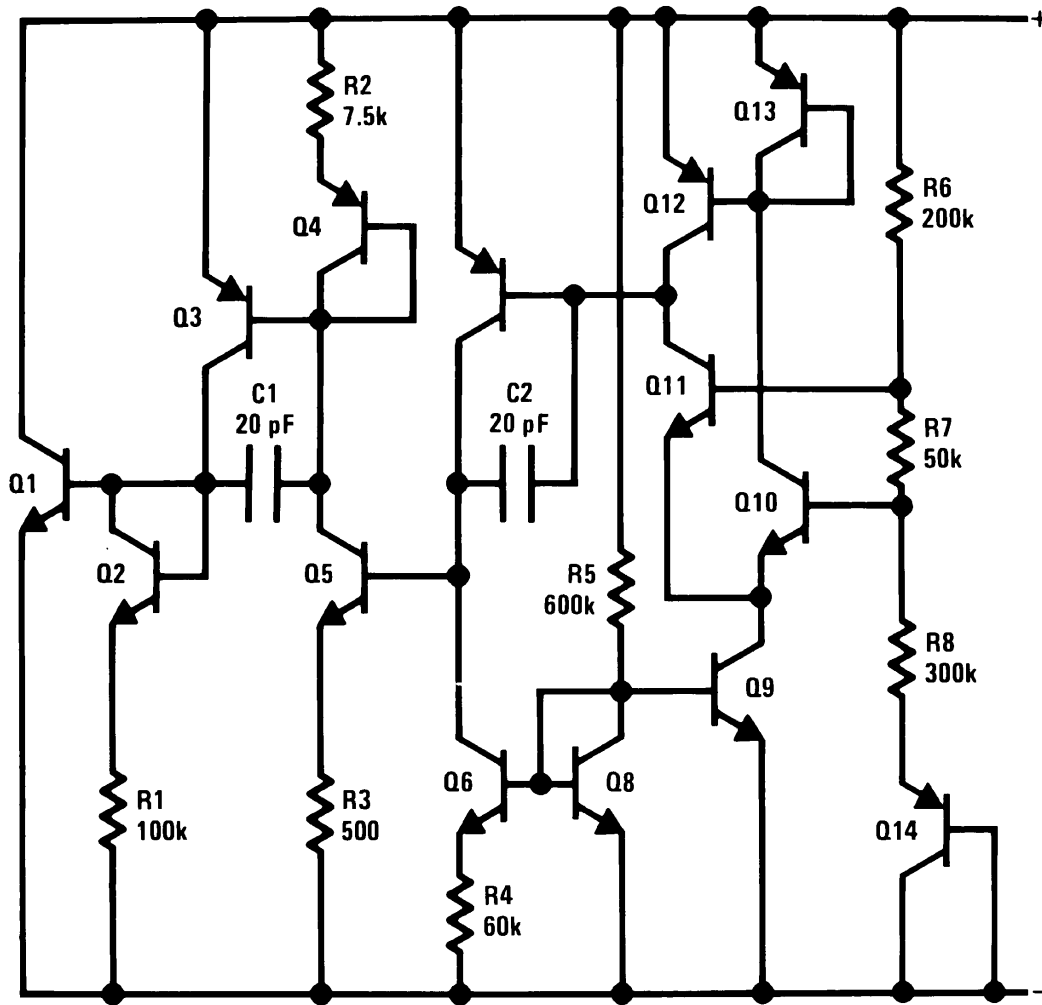


Calibration

1. Adjust R1 so that V1 = temp at 1mV/°K
 2. Adjust V2 to 273.2mV
- $\dagger I_Q$ 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) | Call TI 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) | Call TI 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.

OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of ≤ 1000 ppm threshold. Antimony trioxide based flame retardants must also meet the ≤ 1000 ppm threshold requirement.

(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

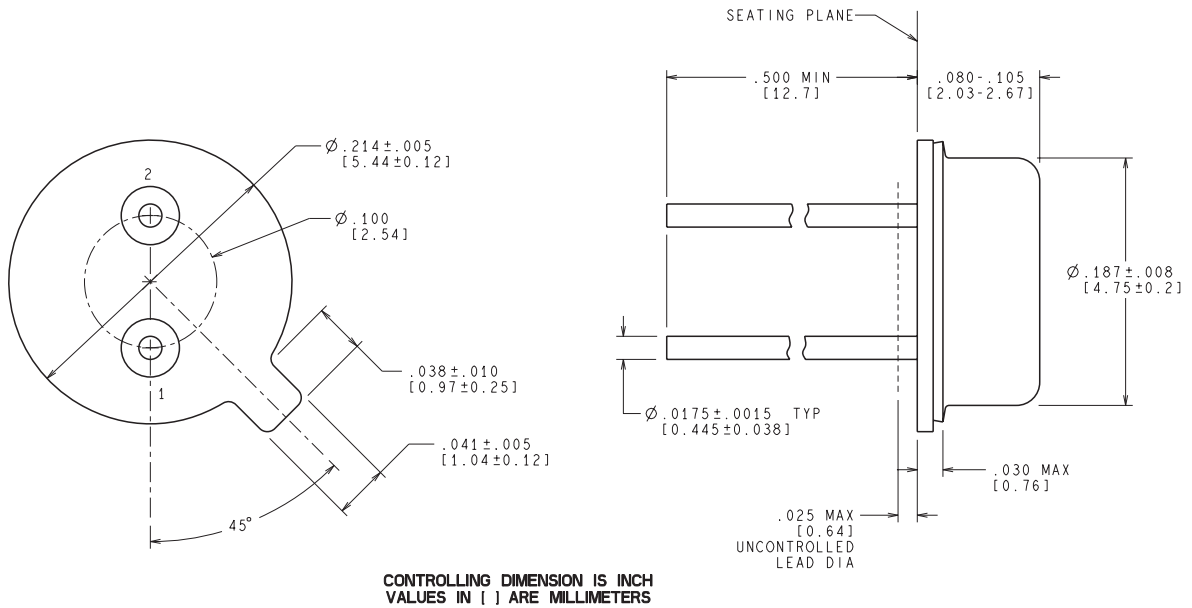
| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LM285BXM-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 |
| LM385BMX-1.2 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.5 | 5.4 | 2.0 | 8.0 | 12.0 | Q1 |
| LM385BMX-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/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 |
| LM285BYMX-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 |
| 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 |
| LM385BYMX-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/NOPB | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |

NDU0002A



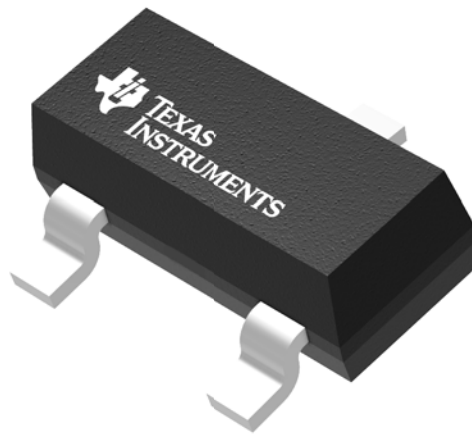
H02A (Rev F)

GENERIC PACKAGE VIEW

DBZ 3

SOT-23 - 1.12 mm max height

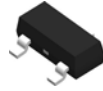
SMALL OUTLINE TRANSISTOR



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

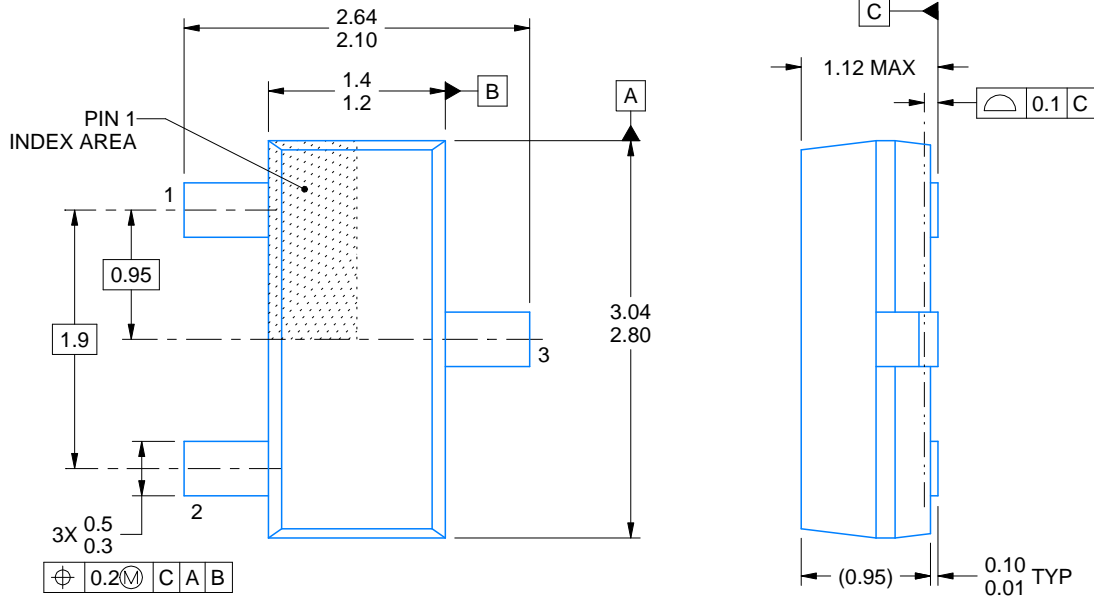
DBZ0003A



PACKAGE OUTLINE

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



4214838/C 04/2017

NOTES:

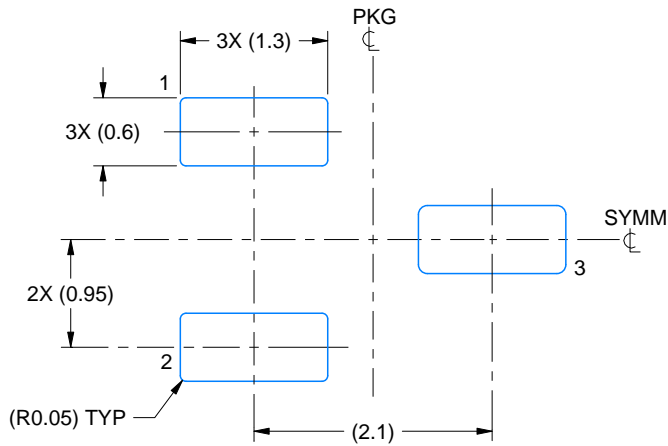
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-236, except minimum foot length.

EXAMPLE BOARD LAYOUT

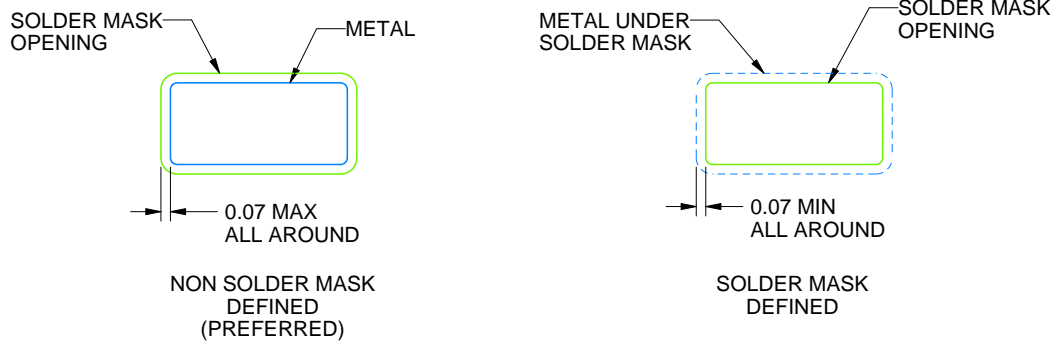
DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
SCALE:15X



SOLDER MASK DETAILS

4214838/C 04/2017

NOTES: (continued)

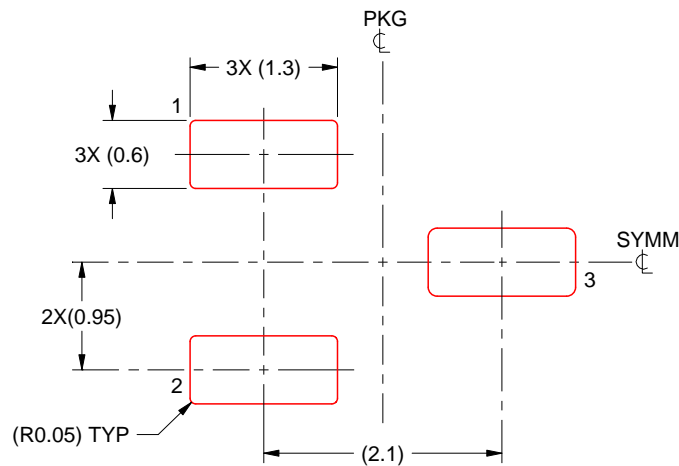
- 4. Publication IPC-7351 may have alternate designs.
- 5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE:15X

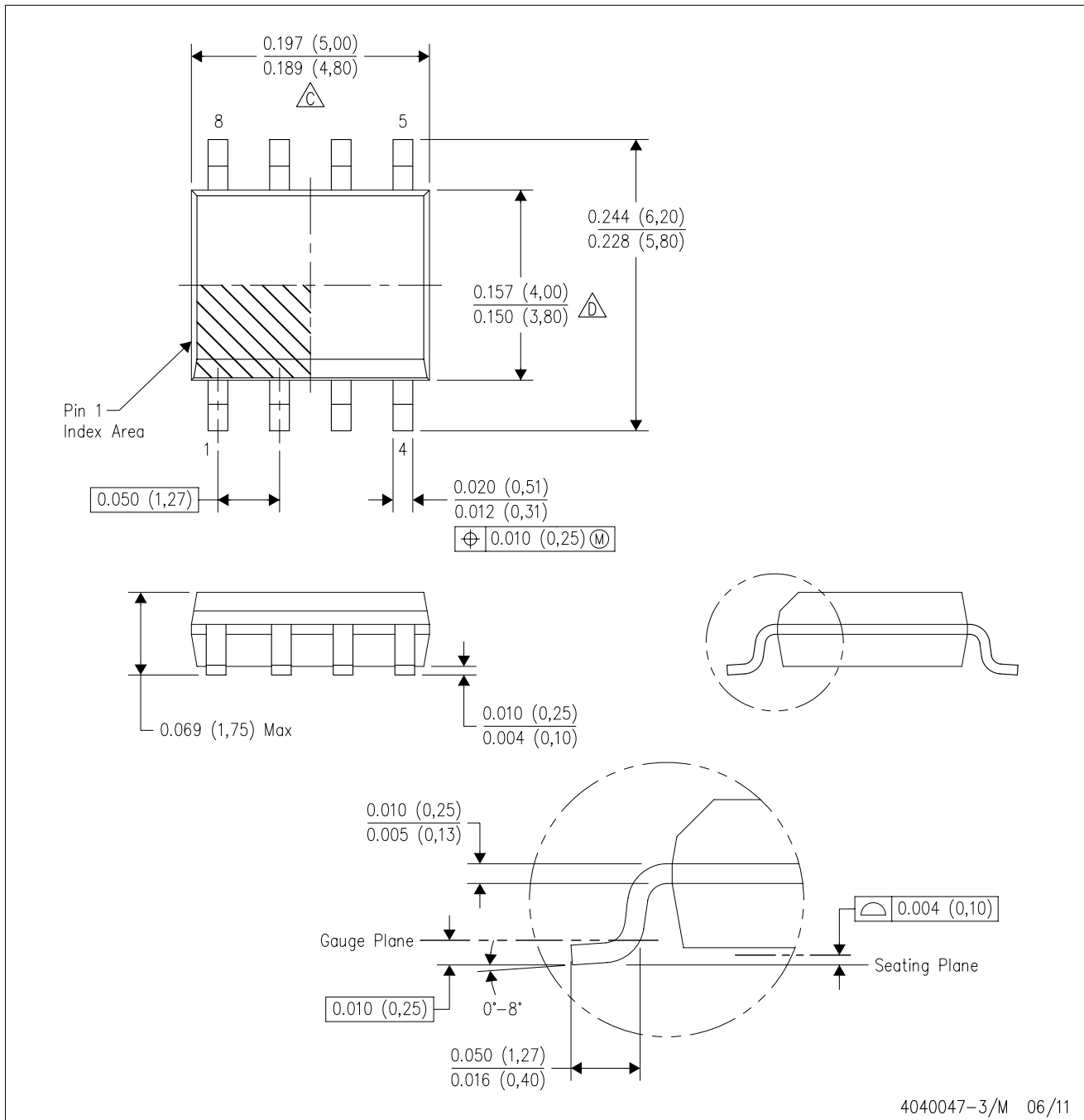
4214838/C 04/2017

NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
7. Board assembly site may have different recommendations for stencil design.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



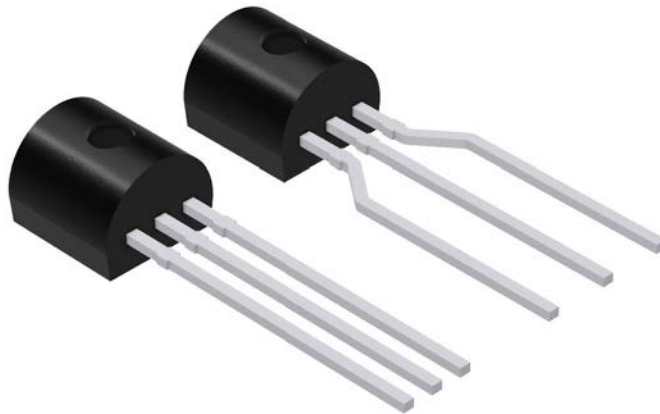
- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - D. Body width does not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

GENERIC PACKAGE VIEW

LP 3

TO-92 - 5.34 mm max height

TRANSISTOR OUTLINE



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

4040001-2/F

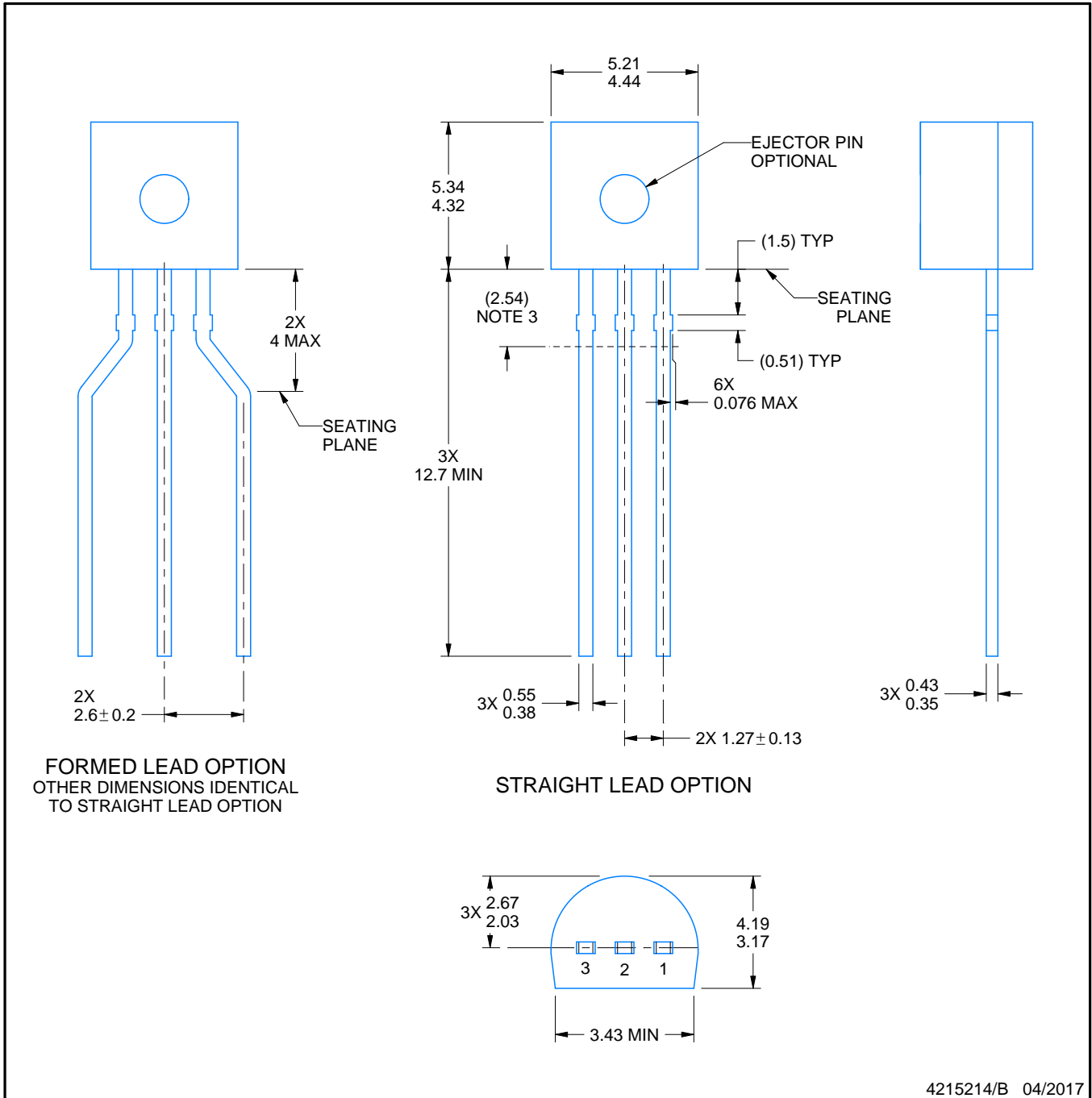
LP0003A



PACKAGE OUTLINE

TO-92 - 5.34 mm max height

TO-92



4215214/B 04/2017

NOTES:

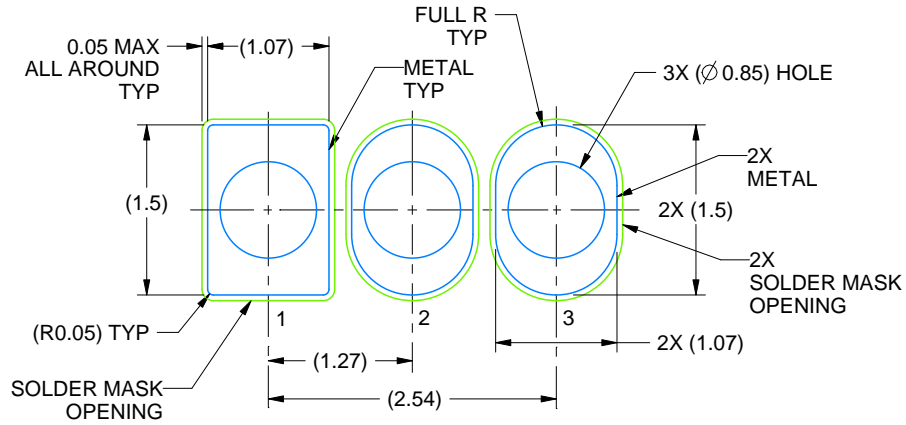
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Lead dimensions are not controlled within this area.
4. Reference JEDEC TO-226, variation AA.
5. Shipping method:
 - a. Straight lead option available in bulk pack only.
 - b. Formed lead option available in tape and reel or ammo pack.
 - c. Specific products can be offered in limited combinations of shipping medium and lead options.
 - d. Consult product folder for more information on available options.

EXAMPLE BOARD LAYOUT

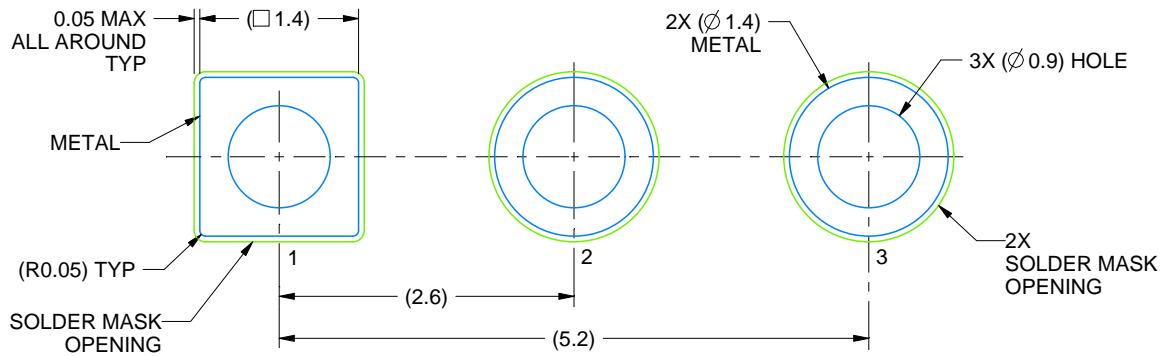
LP0003A

TO-92 - 5.34 mm max height

TO-92



LAND PATTERN EXAMPLE
STRAIGHT LEAD OPTION
NON-SOLDER MASK DEFINED
SCALE:15X



LAND PATTERN EXAMPLE
FORMED LEAD OPTION
NON-SOLDER MASK DEFINED
SCALE:15X

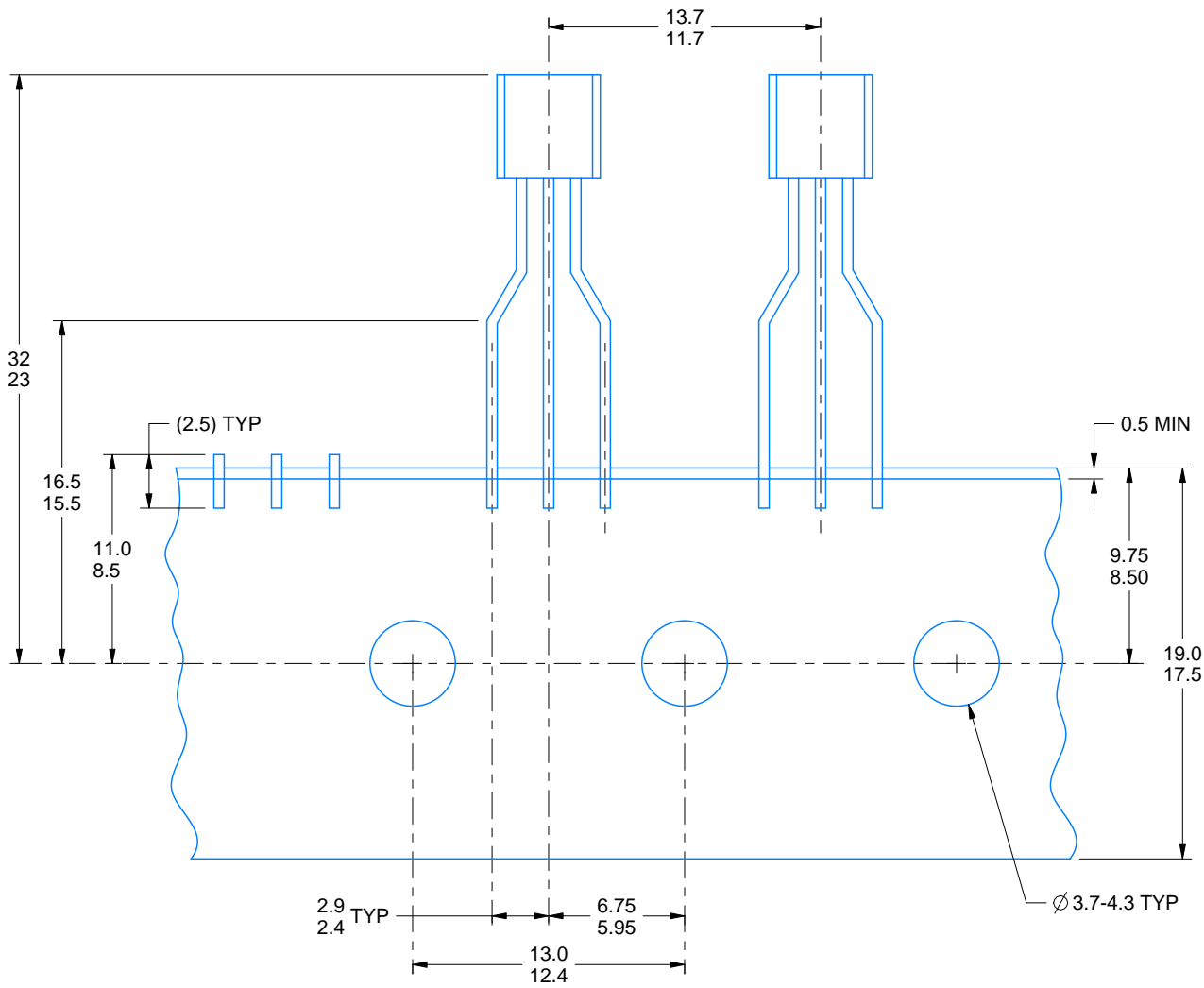
4215214/B 04/2017

TAPE SPECIFICATIONS

LP0003A

TO-92 - 5.34 mm max height

TO-92



FOR FORMED LEAD OPTION PACKAGE

4215214/B 04/2017

IMPORTANT NOTICE

Texas Instruments Incorporated (TI) reserves 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.

TI's published terms of sale for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>) apply to the sale of packaged integrated circuit products that TI has qualified and released to market. Additional terms may apply to the use or sale of other types of TI products and services.

Reproduction of significant portions of TI information in TI 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 reproduced documentation. Information of third parties may be subject to additional restrictions. Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyers and others who are developing systems that incorporate TI products (collectively, "Designers") understand and agree that Designers remain responsible for using their independent analysis, evaluation and judgment in designing their applications and that Designers have full and exclusive responsibility to assure the safety of Designers' applications and compliance of their applications (and of all TI products used in or for Designers' applications) with all applicable regulations, laws and other applicable requirements. Designer represents that, with respect to their applications, Designer has 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. Designer agrees that prior to using or distributing any applications that include TI products, Designer will thoroughly test such applications and the functionality of such TI products as used in such applications.

TI's provision of technical, application or other design advice, quality characterization, reliability data or other 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 TI Resources in any way, Designer (individually or, if Designer is acting on behalf of a company, Designer's company) agrees to use any particular TI Resource 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. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

Designer is 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 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 DESIGNER 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.

Unless TI has explicitly designated an individual product as meeting the requirements of a particular industry standard (e.g., ISO/TS 16949 and ISO 26262), TI is not responsible for any failure to meet such industry standard requirements.

Where TI specifically promotes products as facilitating functional safety or as compliant with industry functional safety standards, such products are intended to help enable customers to design and create their own applications that meet applicable functional safety standards and requirements. Using products in an application does not by itself establish any safety features in the application. Designers must ensure compliance with safety-related requirements and standards applicable to their applications. Designer may not use any TI products in life-critical medical equipment unless authorized officers of the parties have executed a special contract specifically governing such use. Life-critical medical equipment is medical equipment where failure of such equipment would cause serious bodily injury or death (e.g., life support, pacemakers, defibrillators, heart pumps, neurostimulators, and implantables). Such equipment includes, without limitation, all medical devices identified by the U.S. Food and Drug Administration as Class III devices and equivalent classifications outside the U.S.

TI may expressly designate certain products as completing a particular qualification (e.g., Q100, Military Grade, or Enhanced Product). Designers agree that it has the necessary expertise to select the product with the appropriate qualification designation for their applications and that proper product selection is at Designers' own risk. Designers are solely responsible for compliance with all legal and regulatory requirements in connection with such selection.

Designer will fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of Designer's non-compliance with the terms and provisions of this Notice.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Texas Instruments:

[LM285BXM-1.2/NOPB](#) [LM285BXM-1.2/NOPB](#) [LM285BXZ-1.2/LFT4](#) [LM285BXZ-1.2/NOPB](#) [LM285BYM-1.2/NOPB](#)
[LM285BYM-1.2/NOPB](#) [LM285H-1.2](#) [LM285H-1.2/NOPB](#) [LM285M-1.2/NOPB](#) [LM285MX-1.2/NOPB](#) [LM285Z-](#)
[1.2/NOPB](#)