**FEATURES**

- 20µA to 20mA Operating Range
- Guaranteed 1% Initial Voltage Tolerance
- Guaranteed 1Ω Dynamic Impedance
- Very Low Power Consumption

**APPLICATIONS**

- Portable Meter References
- Portable Test Instruments
- Battery-Operated Systems
- Panel Meters
- Current Loop Instrumentation

**DESCRIPTION**

The LM185-2.5 is a two-terminal band gap reference diode that has been designed for applications which require precision performance with micropower operation. The device provides guaranteed operation specifications at currents as low as 20µA. The nominal voltage is 2.5V with both 1% and 2% tolerances available. Some additional features are: maximum dynamic impedance of 1Ω, low noise and excellent stability over time and temperature. The advanced design, processing and testing techniques make Linear’s LM185-2.5 a superior choice over previous designs. A circuit for cold junction compensation of a thermocouple is shown below.

For applications requiring guaranteed temperature drift, see the LT1034 data sheet.

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**TYPICAL APPLICATION**

**Thermocouple Cold Junction Compensator**

**Reverse Voltage Change**

For more information, visit LTC and LT are registered trademarks of Linear Technology Corporation.
## Absolute Maximum Ratings (Note 1)

- **Reverse Breakdown Current** .................. 30mA
- **Forward Current** ................................. 10mA
- **Operating Temperature Range**
  - **LM185-2.5 (OBSOLETE)** ............ –55°C to 125°C
  - **LM285-2.5** .................................. –40°C to 85°C
  - **LM385-2.5** .................................... 0°C to 70°C
- **Storage Temperature Range**
  - **LM185-2.5 (OBSOLETE)** ............ –65°C to 150°C
  - **LM285-2.5** .................................. –65°C to 150°C
  - **LM385-2.5** .................................... –65°C to 150°C
- **Lead Temperature (Soldering, 10 sec.)** .......... 300°C

### Package/Order Information

#### Bottom View
- **H Package**
  - 2-Lead TO-46 Metal Can
- **TJMAX** = 150°C, \(q_{JA} = 440°C/W\), \(q_{JC} = 80°C/W\)

#### Order Part Number
- **LM185H-2.5**
- **LM285H-2.5**
- **LM385H-2.5**
- **LM385BH-2.5**

#### Z Package
- 3-Lead TO-92 Plastic
- **TJMAX** = 100°C, \(q_{JA} = 160°C/W\)

#### OBSOLETE Package
- Consider the S8 or Z Packages for Alternate Source

#### S8 Package
- 8-Lead Plastic SO
- **TJMAX** = 150°C, \(q_{JA} = 220°C/W\)

#### S8 Part Marking
- 2852
- 3852
- 3852B

Consult LTC Marketing for parts specified with wider operating temperature ranges.
**ELECTRICAL CHARACTERISTICS**  The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ C$. (Note 2)

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>LM185-2.5/285-2.5</th>
<th>LM285-2.5/LM385-2.5</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_Z$</td>
<td>Reverse Breakdown Voltage $T_A = 25^\circ C$, $20\mu A \leq I_R \leq 20mA$</td>
<td>2.462</td>
<td>2.500</td>
<td>2.538</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>$T_A = 25^\circ C$, $LM185-2.5/285-2.5$</td>
<td>2.425</td>
<td>2.500</td>
<td>2.575</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>$LM385-2.5$</td>
<td>2.462</td>
<td>2.500</td>
<td>2.538</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>$LM385B-2.5$ (Note 3)</td>
<td>2.462</td>
<td>2.500</td>
<td>2.538</td>
<td>V</td>
</tr>
<tr>
<td>$\frac{\Delta V_Z}{\Delta Temp}$</td>
<td>Average Temperature Coefficient $20\mu A \leq I_R \leq 20mA$ (Note 3)</td>
<td>20</td>
<td>20</td>
<td>ppm/$^\circ C$</td>
<td></td>
</tr>
<tr>
<td>$I_{MIN}$</td>
<td>Minimum Operating Current $T_{MIN} \leq T_A \leq T_{MAX}$</td>
<td>●</td>
<td>8</td>
<td>20</td>
<td>μA</td>
</tr>
<tr>
<td>$\frac{\Delta V_Z}{\Delta I_R}$</td>
<td>Reverse Breakdown Voltage Change With Current $20\mu A \leq I_R \leq 1mA$ $T_A = 25^\circ C$</td>
<td>1.0</td>
<td>2.0</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$T_{MIN} \leq T_A \leq T_{MAX}$</td>
<td>●</td>
<td>1.5</td>
<td>2.5</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td>$1mA \leq I_R \leq 20mA$ $T_A = 25^\circ C$ $T_{MIN} \leq T_A \leq T_{MAX}$</td>
<td>●</td>
<td>10</td>
<td>20</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td>$20mA \leq I_R \leq 20mA$</td>
<td>●</td>
<td>20</td>
<td>25</td>
<td>mV</td>
</tr>
<tr>
<td>$r_Z$</td>
<td>Reverse Dynamic Impedance $I_R = 100\mu A$ (Note 4) $T_A = 25^\circ C$</td>
<td>0.2</td>
<td>0.6</td>
<td>0.4</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>$T_{MIN} \leq T_A \leq T_{MAX}$</td>
<td>●</td>
<td>0.6</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>$e_{n}$</td>
<td>Wide Band Noise (RMS) $10Hz \leq f \leq 10kHz$, $I_R = 100\mu A$</td>
<td>120</td>
<td>120</td>
<td>μV</td>
<td></td>
</tr>
<tr>
<td>$\frac{\Delta V_Z}{\Delta Time}$</td>
<td>Long Term Stability $T_A = 25^\circ C \pm 0.1^\circ C$, $I_R = 100\mu A$</td>
<td>20</td>
<td>20</td>
<td>ppm/kHr</td>
<td></td>
</tr>
</tbody>
</table>

**Note 1:** Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

**Note 2:** All specifications are for $T_A = 25^\circ C$ unless otherwise noted. For the LM185-2.5 $T_{MIN} = -55^\circ C$ and $T_{MAX} = 125^\circ C$. For LM285-2.5, $T_{MIN} = -40^\circ C$ and $T_{MAX} = 85^\circ C$. For LM385-2.5, $T_{MIN} = 0^\circ C$ and $T_{MAX} = 70^\circ C$. For LM385B-2.5, $T_{MIN} = 0^\circ C$ and $T_{MAX} = 70^\circ C$.

**Note 3:** For very low initial tolerance, consult LT1004 data sheet. The LT1004 is a low cost, pin for pin substitution device. For guaranteed temperature coefficient consult the LT1034-2.5 data sheet.

**Note 4:** Guaranteed but not tested.
**TYPICAL PERFORMANCE CHARACTERISTICS**

**Reverse Characteristics**

- Temperature: -55°C to 125°C
- Reverse Current (mA): 0.1 to 10
- Reverse Voltage (V): 0.1 to 3.0

**Forward Characteristics**

- Temperature: -55°C to 125°C
- Forward Current (mA): 0.4
- Forward Voltage (V): 0.8 to 1.6

**Temperature Drift**

- Reference Voltage (V): 2.480 to 2.525
- Temperature (°C): -55 to 125

**Reverse Dynamic Impedance**

- Frequency (Hz): 10 to 100k
- Dynamic Impedance (Ω): 0.01 to 10

**Noise Voltage**

- Frequency (Hz): 10 to 100k
- Noise Voltage (mV/√Hz): 0 to 1400

**Filtered Output Noise**

- Cutoff Frequency (Hz): 100 to 100k
- Integrated Noise (μV/√Hz): 0 to 120

**Response Time**

- Time (μS): 0 to 500
- Voltage (V): 0 to 5

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**LINEAR TECHNOLOGY**
SCHEMATIC DIAGRAM

PACKAGE DESCRIPTION

H Package
2-Lead and 3-Lead TO-46 Metal Can
(Reference LTC DWG # 05-08-1340)

REFERENCE PLANE

0.016 – 0.021**
(0.406 – 0.533)
DIA

0.025
(0.635)
MAX

0.029 – 0.219
(5.309 – 5.537)

0.178 – 0.195
(4.521 – 4.953)
MIN

0.085 – 0.105
(2.159 – 2.667)

0.500
(12.700)
TYP

0.050
(1.270)
TYP

0.100
(2.540)
TYP

0.028 – 0.048
(0.711 – 1.219)
FOR 3-LEAD PACKAGE ONLY

0.036 – 0.046
(0.914 – 1.168)
FOR 3-LEAD PACKAGE ONLY

* LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND 0.045" BELOW THE REFERENCE PLANE
** FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS 0.016 – 0.024
(0.406 – 0.610)

OBSOLETE PACKAGE
S8 Package
8-Lead Plastic Small Outline (Narrow .150 Inch)
(Reference LTC DWG # 05-08-1610)

DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006” (0.152mm) PER SIDE
**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010” (0.254mm) PER SIDE
Z Package
3-Lead Plastic TO-92 (Similar to TO-226)
(Reference LTC DWG # 05-08-1410)

TO-92 TAPE AND REEL
REFER TO TAPE AND REEL SECTION OF
LTC DATA BOOK FOR ADDITIONAL INFORMATION

Information furnished by Linear Technology Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. Linear Technology Corporation makes no representation that the interconnection of circuits as described herein will not infringe on existing patent rights.
LM185-2.5/
LM285-2.5/LM385-2.5

TYPICAL APPLICATIONS

REFERENCE FROM A 9V BATTERY

OPERATION OVER A WIDE SUPPLY RANGE

3.7V ≤ V+ ≤ 30V

LM385-2.5

2.7k

LM334

2.5V

PART NUMBER | DESCRIPTION | COMMENTS
-------------|-------------|-------------------
LT1634       | Micropower Shunt Voltage Reference | 0.05% Initial Accuracy, 10ppm/°C Maximum Tempco Output Voltage: 1.25V, 2.5V, 4.096V and 5V