

### FEATURES

- 10 $\mu$ A to 20mA Operating Range
- *Guaranteed* 1% Initial Voltage Tolerance
- *Guaranteed* 1 $\Omega$  Dynamic Impedance
- Very Low Power Consumption

### APPLICATIONS

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

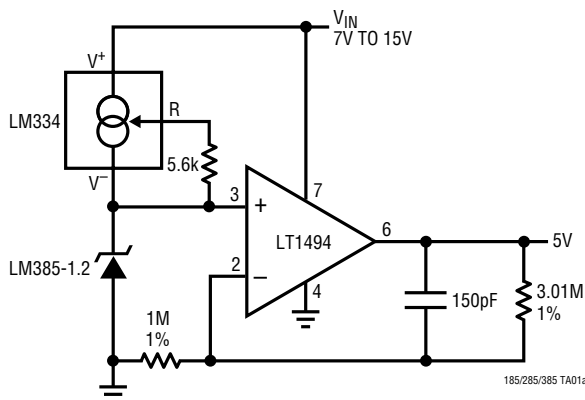
### DESCRIPTION

The LM185-1.2 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 operating specifications at currents as low as 10 $\mu$ A. The nominal voltage is 1.235V with both 1% and 2% tolerances available. Some additional features are: maximum dynamic impedance of 1 $\Omega$ , low noise and excellent stability over time and temperature. Advanced design, processing and testing techniques make Linear's LM185-1.2 a superior choice over previous designs. A micropower 5V reference application is shown below. For guaranteed TC, micropower references, see the LT1034 data sheet.

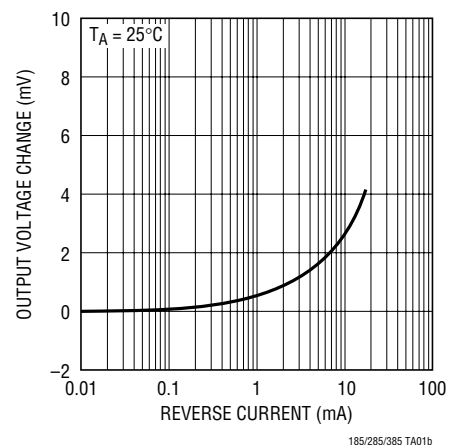
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### TYPICAL APPLICATION

Micropower 5V Reference



Reverse Voltage Change with Current

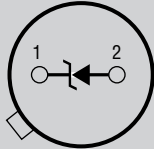
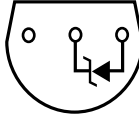
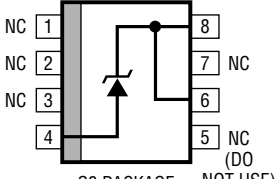


LM185-1.2/  
LM285-1.2/LM385-1.2

ABSOLUTE MAXIMUM RATINGS

|                             |                                            |                |
|-----------------------------|--------------------------------------------|----------------|
| Operating Temperature Range | Storage Temperature Range .....            | –65°C to 150°C |
| LM185-1.2(OBSOLETE) .....   | Lead Temperature (Soldering, 10 sec) ..... | 300°C          |
| LM285-1.2 .....             | Reverse Breakdown Current .....            | 30mA           |
| LM385-1.2 .....             | Forward Current .....                      | 10mA           |
|                             |                                            |                |

PACKAGE/ORDER INFORMATION

|                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                              |                                                                                                                                                                                                                                                     |                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| <p>BOTTOM VIEW</p>  <p>H PACKAGE<br/>2-LEAD TO-46 METAL CAN</p> <p><math>T_{JMAX} = 150^{\circ}C</math>,<br/><math>\theta_{JA} = 440^{\circ}C/W</math>, <math>\theta_{JC} = 80^{\circ}C/W</math><br/>(NOTE 3)</p> <p><b>OBSOLETE PACKAGE</b><br/>Consider the S8 or Z Packages for Alternate Source</p> | <p>ORDER PART<br/>NUMBER</p> <p>LM185H-1.2<br/>LM285H-1.2<br/>LM385H-1.2<br/>LM385BH-1.2</p> | <p>BOTTOM VIEW</p>  <p>Z PACKAGE<br/>3-LEAD PLASTIC TO-92</p> <p><math>T_{JMAX} = 150^{\circ}C</math>, <math>\theta_{JA} = 160^{\circ}C/W</math><br/>(NOTE 3)</p> | <p>ORDER PART<br/>NUMBER</p> <p>LM285Z-1.2<br/>LM385Z-1.2<br/>LM385BZ-1.2</p> |
| <p>TOP VIEW</p>  <p>S8 PACKAGE<br/>8-LEAD PLASTIC SO</p> <p><math>T_{JMAX} = 150^{\circ}C</math>, <math>\theta_{JA} = 190^{\circ}C/W</math></p>                                                                                                                                                       |                                                                                              |                                                                                                                                                                                                                                                     | <p>ORDER PART<br/>NUMBER</p> <p>LM385BS8-1.2<br/>LM385S8-1.2</p>              |
|                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                              |                                                                                                                                                                                                                                                     | <p>S8 PART<br/>MARKING</p> <p>3851<br/>3851B</p>                              |

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  $T_A = 25^\circ\text{C}$ . For the LM185-1.2  $T_{\text{MIN}} = -55^\circ\text{C}$  and  $T_{\text{MAX}} = 125^\circ\text{C}$ . For LM285-1.2  $T_{\text{MIN}} = -40^\circ\text{C}$  and  $T_{\text{MAX}} = 85^\circ\text{C}$ . For LM385-1.2  $T_{\text{MIN}} = 0^\circ\text{C}$  and  $T_{\text{MAX}} = 70^\circ\text{C}$ . For MIL-STD components, please refer to LTC883C data sheet for test listing and parameters.

| SYMBOL                                  | PARAMETER                                     | CONDITIONS                                                                                                             | LM185-1.2/LM285-1.2 |       |            | LM385-1.2/LM385B-1.2 |                |                | UNITS                 |
|-----------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------|-------|------------|----------------------|----------------|----------------|-----------------------|
|                                         |                                               |                                                                                                                        | MIN                 | TYP   | MAX        | MIN                  | TYP            | MAX            |                       |
| $V_Z$                                   | Reverse Breakdown Voltage                     | $T_A = 25^\circ\text{C}$ , $I_{\text{MIN}} \leq I_R \leq 20\text{mA}$<br>LM185-1.2<br>LM385-1.2<br>LM385B-1.2 (Note 3) | 1.223               | 1.235 | 1.247      | 1.205<br>1.223       | 1.235<br>1.235 | 1.260<br>1.247 | V<br>V<br>V           |
| $\frac{\Delta V_Z}{\Delta \text{Temp}}$ | Average Temperature Coefficient               | $I_{\text{MIN}} \leq I_R \leq 20\text{mA}$ (Notes 2, 3)                                                                |                     | 20    |            |                      | 20             |                | ppm/ $^\circ\text{C}$ |
| $I_{\text{MIN}}$                        | Minimum Operating Current                     | $T_{\text{MIN}} \leq T_A \leq T_{\text{MAX}}$                                                                          | ●                   | 8     | 10         |                      | 8              | 15             | $\mu\text{A}$         |
| $\frac{\Delta V_Z}{\Delta I_R}$         | Reverse Breakdown Voltage Change with Current | $I_{\text{MIN}} \leq I_R \leq 1\text{mA}$<br>$T_A = 25^\circ\text{C}$<br>$T_{\text{MIN}} \leq T_A \leq T_{\text{MAX}}$ |                     |       | 1<br>1.5   |                      |                | 1<br>1.5       | mV<br>mV              |
|                                         |                                               | $1\text{mA} \leq I_R \leq 20\text{mA}$<br>$T_A = 25^\circ\text{C}$<br>$T_{\text{MIN}} \leq T_A \leq T_{\text{MAX}}$    |                     |       | 10<br>20   |                      |                | 10<br>25       | mV<br>mV              |
|                                         |                                               |                                                                                                                        |                     |       |            |                      |                |                |                       |
| $r_Z$                                   | Reverse Dynamic Impedance                     | $I_R = 100\mu\text{A}$<br>$T_A = 25^\circ\text{C}$<br>$T_{\text{MIN}} \leq T_A \leq T_{\text{MAX}}$                    | ●                   | 0.2   | 0.6<br>1.5 |                      | 0.4            | 1.0<br>1.5     | $\Omega$<br>$\Omega$  |
| $e_n$                                   | Wideband Noise (RMS)                          | $I_R = 100\mu\text{A}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$                                                        |                     | 60    |            |                      | 60             |                | $\mu\text{V}$         |
| $\frac{\Delta V_Z}{\Delta \text{Time}}$ | Long Term Stability                           | $I_R = 100\mu\text{A}$ , $T_A = 25^\circ\text{C} \pm 0.1^\circ\text{C}$                                                |                     | 20    |            |                      | 20             |                | ppm/kHr               |

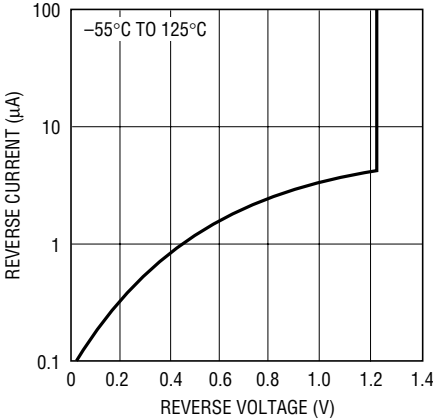
**Note 1:** Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

**Note 2:** Selected devices with guaranteed maximum temperature coefficient are available upon request.

**Note 3:** For applications requiring low initial tolerance guaranteed over temperature consult the LT1004 data sheet.

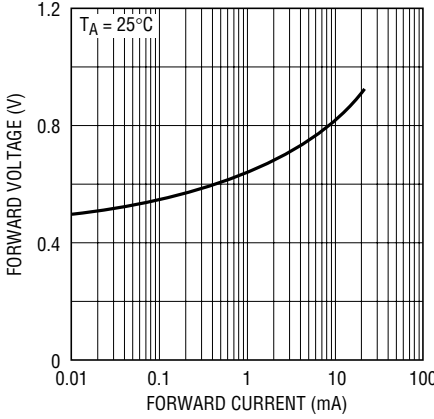
TYPICAL PERFORMANCE CHARACTERISTICS

Reverse Characteristics



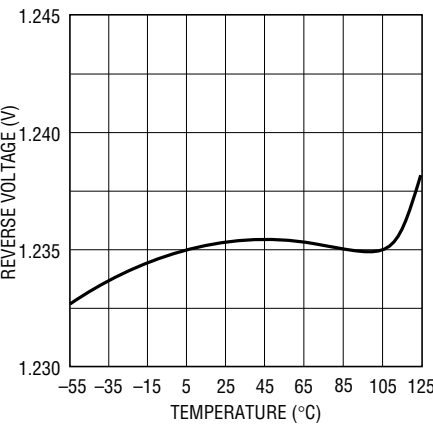
185/285/385 G01

Foward Characteristics



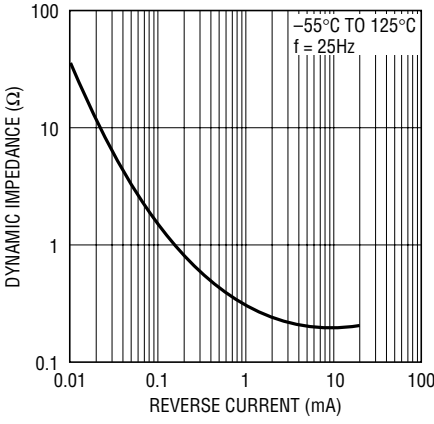
185/285/385 G02

Temperature Drift



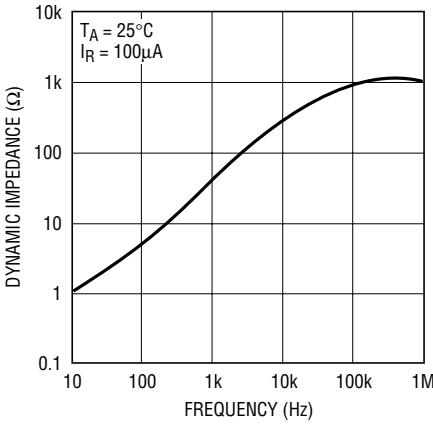
185/285/385 G03

Reverse Dynamic Impedance



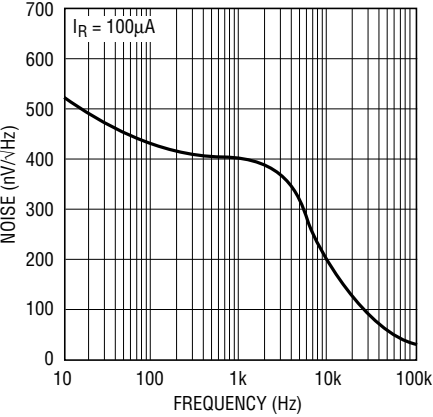
185/285/385 G04

Reverse Dynamic Impedance



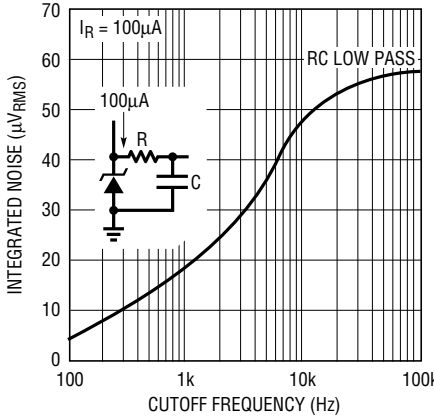
185/285/385 G05

Noise Voltage



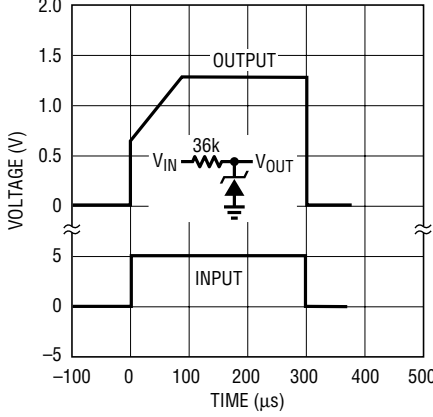
185/285/385 G06

Filtered Output Noise



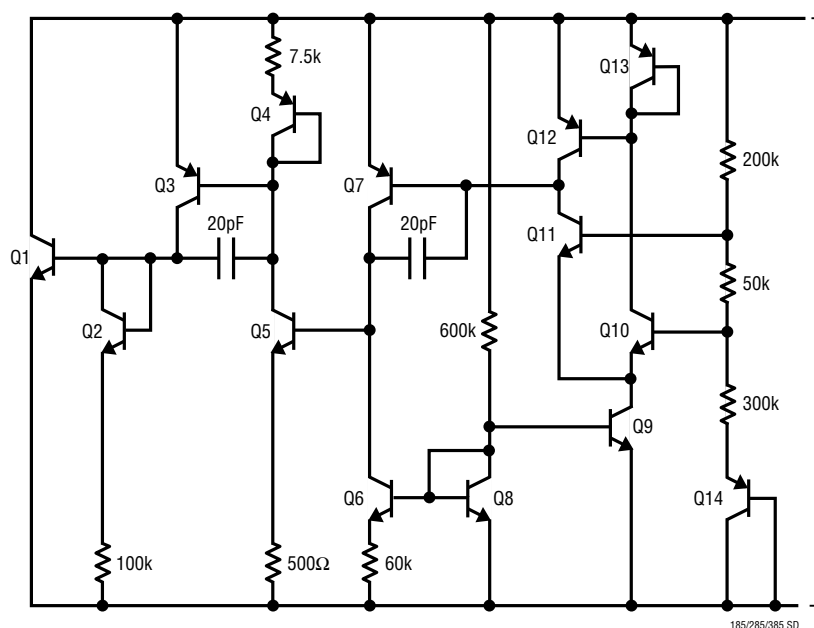
185/285/385 G07

Response Time



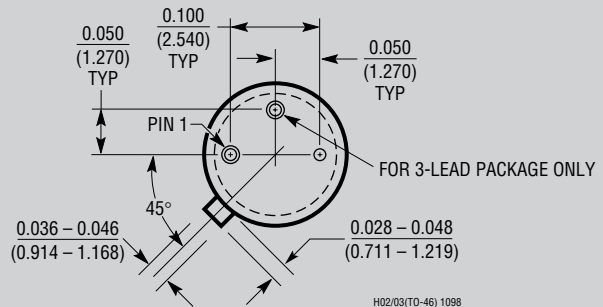
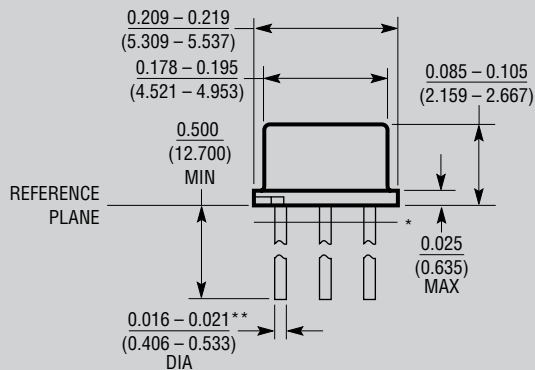
185/285/385 G08

## SCHEMATIC DIAGRAM



## PACKAGE DESCRIPTION

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

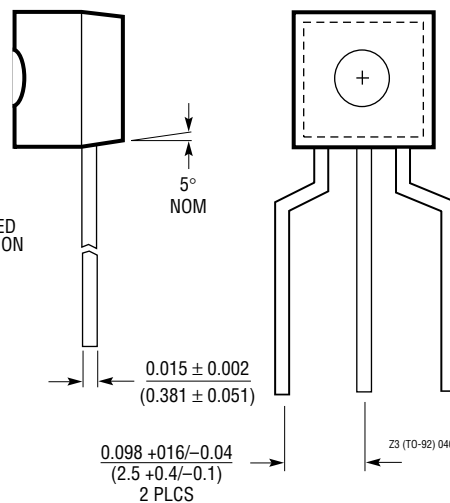
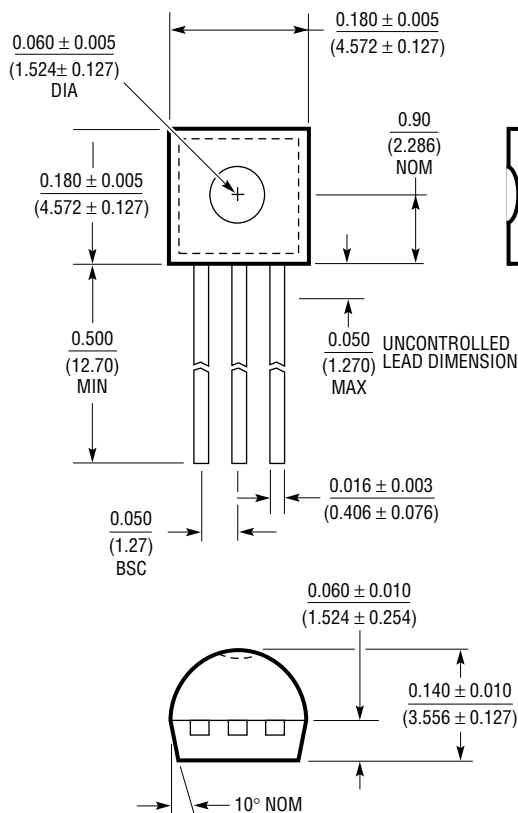


\* LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND 0.045" BELOW THE REFERENCE PLANE

\*\*FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS  $\frac{0.016 - 0.024}{(0.406 - 0.610)}$

### OBsolete PACKAGE

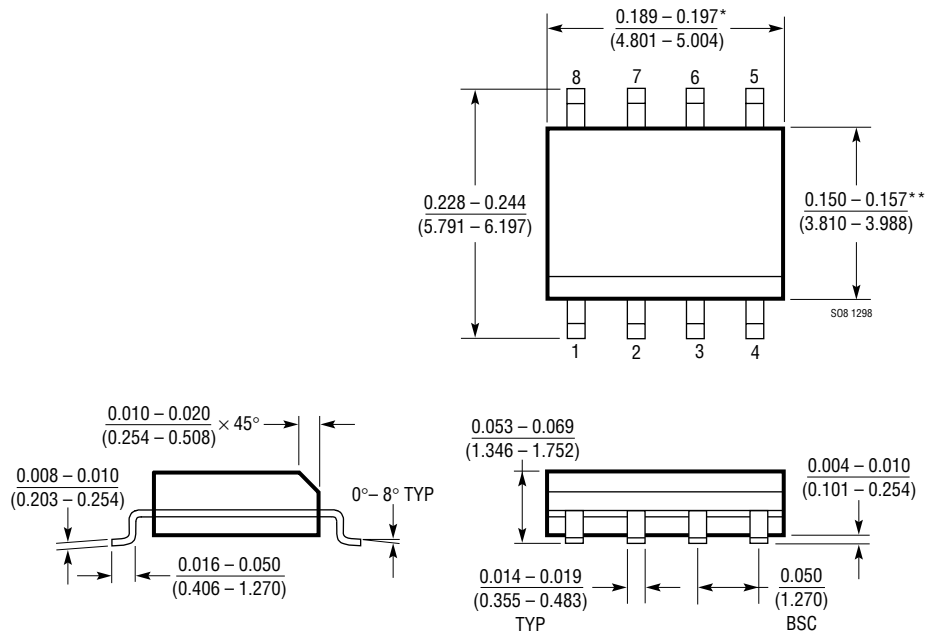
### Z Package 3-Lead Plastic TO-92 (Similar to TO-226) (Reference LTC DWG # 05-08-1410)



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

## PACKAGE DESCRIPTION

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



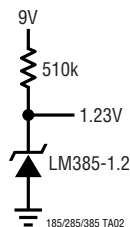
\*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

\*\*DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

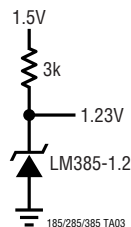
# LM185-1.2/ LM285-1.2/LM385-1.2

## TYPICAL APPLICATIONS

Micropower Reference for 9V Battery



1.2V Reference from 1.5V Battery



## RELATED PARTS

| PART NUMBER | DESCRIPTION                     | COMMENTS                             |
|-------------|---------------------------------|--------------------------------------|
| LT1004-1.2  | Micropower Shunt Reference      | 0.3% Initial Accuracy                |
| LT1034      | 1.2V Micropower Shunt Reference | 40ppm/°C Max Temperature Coefficient |