

#### DESCRIPTION

The LM385/385B Micropower Voltage References are two terminal bandgap reference diodes designed and optimized for accurate low power operation in portable and other power sensitive systems. Operating currents are guaranteed from as low as 15µA up to 20mA for the LM385/385B-1.2, and 20µA up to 20mA for the LM385/385B-2.5, giving designers a great deal of flexibility in optimizing power consumption, noise and ultimate application performance. As an added feature, the references output impedance is extraordinarily low over the entire operating range of quiescent currents. This enables an extremely wide dynamic load range with little effect on

the overall reference accuracy.

The LM385 family is available in fixed 1.2V and 2.5V reference values. Process and circuit design optimization provide for high accuracy with initial tolerance values of 1% for the LM385B-1.2, 2% for the LM385-1.2, 1.5% for the LM385B-2.5, and 3% for the LM385-2.5. Complementing their initial accuracy, the bandgap reference is temperature compensated to deliver 20ppm performance over the 0° to 70°C operating temperature range.

The LM385 family from Linfinity is a pin-for-pin replacement for the LM385/385B family of voltage references.

#### KEY FEATURES

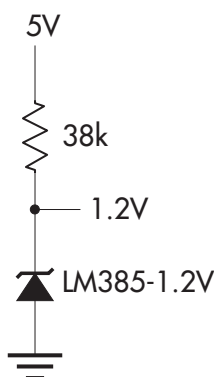
- **GUARANTEED 1% INITIAL ACCURACY (LM385B-1.2)**
- **GUARANTEED 2.5% INITIAL ACCURACY (LM385-1.2)**
- **GUARANTEED 1.5% INITIAL ACCURACY (LM385B-2.5)**
- **GUARANTEED 3% INITIAL ACCURACY (LM385-2.5)**
- **GUARANTEED 20µA OPERATING CURRENT**
- **LOW TEMPERATURE COEFFICIENT**
- **OPERATING CURRENT OF 20µA TO 20mA**
- **VERY LOW DYNAMIC IMPEDANCE . . . 1Ω**

#### APPLICATIONS

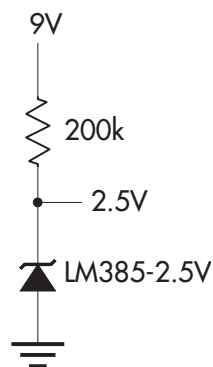
- **PORTABLE METER REFERENCES**
- **PORTABLE TEST INSTRUMENTS**
- **BATTERY OPERATED SYSTEMS**
- **CURRENT LOOP INSTRUMENTATION**

#### PRODUCT HIGHLIGHT

##### 1.2V REFERENCE



##### MICROPOWER REFERENCE FROM 9V BATTERY



#### PACKAGE ORDER INFORMATION

| T <sub>A</sub> (°C) | Reference Voltage | Initial Tolerance | DM Plastic SOIC 8-pin | LP Plastic TO-92 3-pin |
|---------------------|-------------------|-------------------|-----------------------|------------------------|
| 0 to 70             | 1.2V              | ±30mV             | LM385DM-1.2           | LM385LP-1.2            |
|                     |                   | ±12mV             | LM385BDM-1.2          | LM385BLP-1.2           |
|                     | 2.5V              | ±75mV             | LM385DM-2.5           | LM385LP-2.5            |
|                     |                   | ±38mV             | LM385BDM-2.5          | LM385BLP-2.5           |

Note: All surface-mount packages are available in Tape & Reel.  
Append the letter "T" to part number. (i.e. LM385DM-2.5T)

FOR FURTHER INFORMATION CALL (714) 898-8121

# LM385/385B

## 1.2 & 2.5V MICROPOWER VOLTAGE REFERENCE

### PRODUCTION DATA SHEET

#### ABSOLUTE MAXIMUM RATINGS (Note 1)

Reverse Breakdown Current ..... 30mA  
Forward Current ..... 10mA  
Operating Temperature Range  
LM385 ..... 0°C to 70°C  
Storage Temperature Range ..... -65°C to 150°C  
Lead Temperature (soldering, 10 seconds) ..... 300°C

Note 1. Values beyond which damage may occur. All voltages are specified with respect to ground, and all currents are positive into the specified terminal

#### THERMAL DATA

##### DM PACKAGE:

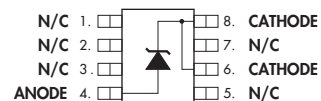
|   |         |
|---|---------|
| THERMAL RESISTANCE-JUNCTION TO AMBIENT, $\theta_{JA}$ | 165°C/W |
|---|---------|

##### LP PACKAGE:

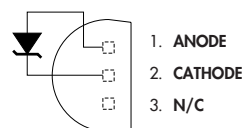
|   |         |
|---|---------|
| THERMAL RESISTANCE-JUNCTION TO AMBIENT, $\theta_{JA}$ | 165°C/W |
|---|---------|

The  $\theta_{JA}$  numbers are guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

#### PACKAGE PIN OUTS



DM PACKAGE  
(Top View)



LP PACKAGE  
(Top View)

## 1.2 &amp; 2.5V MICROPOWER VOLTAGE REFERENCE

## PRODUCTION DATA SHEET

## ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, these specifications apply to  $T_A = 25^\circ\text{C}$ . Typ number represents  $T_A = 25^\circ\text{C}$  value.)

## LM385/385B-1.2

| Parameter                                       | Symbol                                  | Test Conditions   | LM385/385B-1.2 |       |       | Units                 |
|---|---|---|----------------|-------|-------|-----------------------|
|   |   |   | Min.           | Typ.  | Max.  |                       |
| Reverse Breakdown Voltage                       | LM385                                   | $V_Z$   | 1.205          | 1.235 | 1.260 | V                     |
|   | LM385B                                  | $I_{MIN} \leq I_R \leq I_{MAX}$   | 1.223          | 1.235 | 1.247 | V                     |
| Average Temperature Coefficient                 | $\frac{\Delta V_Z}{\Delta \text{Temp}}$ | $I_R = 100\mu\text{A}$  |                | 20    |       | ppm/ $^\circ\text{C}$ |
| Minimum Operating Current                       | $I_{MIN}$                               |   |                | 8     | 15    | $\mu\text{A}$         |
| Reverse Breakdown Voltage Chang<br>with Current | $e$                                     | $\Delta V_Z$ $I_{MIN} \leq I_R \leq 1\text{mA}$                         |                |       | 1.5   | mV                    |
|   | $\Delta I_R$                            | $1\text{mA} \leq I_R \leq 20\text{mA}$                                  |                |       | 20    | mV                    |
| Reverse Dynamic Impedance                       | $r_z$                                   | $I_R = 100\mu\text{A}$  |                | 1     |       | $\Omega$              |
| Wide Band Noise (RMS)                           | $e_n$                                   | $I_R = 100\mu\text{A}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$         |                | 60    |       | $\mu\text{V}$         |
| Long Term Stability                             | $\frac{\Delta V_Z}{\Delta \text{Time}}$ | $I_R = 100\mu\text{A}$ , $T_A = 25^\circ\text{C} \pm 0.1^\circ\text{C}$ |                | 20    |       | ppm/kHr               |

## LM385/385B-2.5

| Parameter                                       | Symbol                                  | Test Conditions   | LM385/385B-2.5 |       |       | Units                 |
|---|---|---|----------------|-------|-------|-----------------------|
|   |   |   | Min.           | Typ.  | Max.  |                       |
| Reverse Breakdown Voltage                       | LM385                                   | $V_Z$   | 2.425          | 2.500 | 2.575 | V                     |
|   | LM385B                                  | $I_{MIN} \leq I_R \leq I_{MAX}$   | 2.462          | 2.500 | 2.538 | V                     |
| Average Temperature Coefficient                 | $\frac{\Delta V_Z}{\Delta \text{Temp}}$ | $I_R = 100\mu\text{A}$  |                | 20    |       | ppm/ $^\circ\text{C}$ |
| Minimum Operating Current                       | $I_{MIN}$                               |   |                | 13    | 20    | $\mu\text{A}$         |
| Reverse Breakdown Voltage Chang<br>with Current | $e$                                     | $\Delta V_Z$ $I_{MIN} \leq I_R \leq 1\text{mA}$                         |                |       | 2     | mV                    |
|   | $\Delta I_R$                            | $1\text{mA} \leq I_R \leq 20\text{mA}$                                  |                |       | 20    | mV                    |
| Reverse Dynamic Impedance                       | $r_z$                                   | $I_R = 100\mu\text{A}$ , $f = 20\text{Hz}$                              |                | 1     |       | $\Omega$              |
| Wide Band Noise (RMS)                           | $e_n$                                   | $I_R = 100\mu\text{A}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$         |                | 120   |       | $\mu\text{V}$         |
| Long Term Stability                             | $\frac{\Delta V_Z}{\Delta \text{Time}}$ | $I_R = 100\mu\text{A}$ , $T_A = 25^\circ\text{C} \pm 0.1^\circ\text{C}$ |                | 20    |       | ppm/kHr               |

## GRAPH / CURVE INDEX

## Characteristic Curves

## LM385/385B-1.2

## FIGURE #

1. RESPONSE TIME
2. REVERSE CHARACTERISTICS
3. FORWARD CHARACTERISTICS
4. TEMPERATURE DRIFT
5. REVERSE VOLTAGE CHANGE
6. REVERSE DYNAMIC IMPEDANCE
7. NOISE VOLTAGE

## Characteristic Curves

## LM385/385B-2.5

## FIGURE #

8. RESPONSE TIME
9. REVERSE CHARACTERISTICS
10. FORWARD CHARACTERISTICS
11. TEMPERATURE DRIFT
12. REVERSE DYNAMIC IMPEDANCE
13. NOISE VOLTAGE

#### CHARACTERISTIC CURVES — LM385/385B-1.2V

FIGURE 1. — RESPONSE TIME

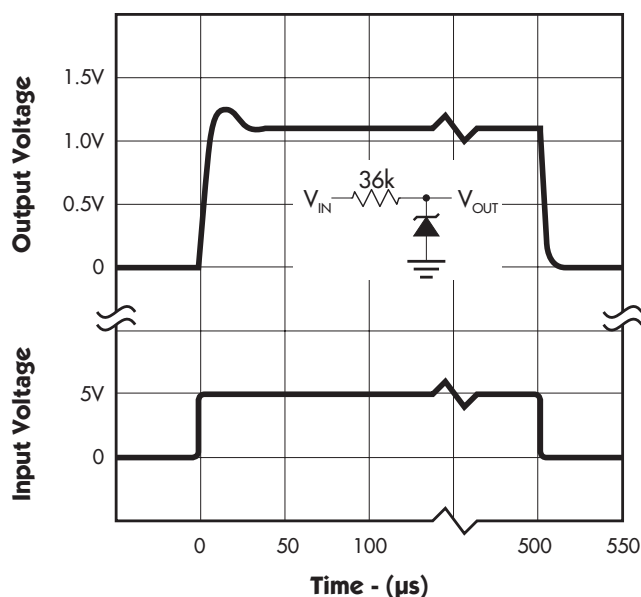


FIGURE 2. — REVERSE CHARACTERISTICS

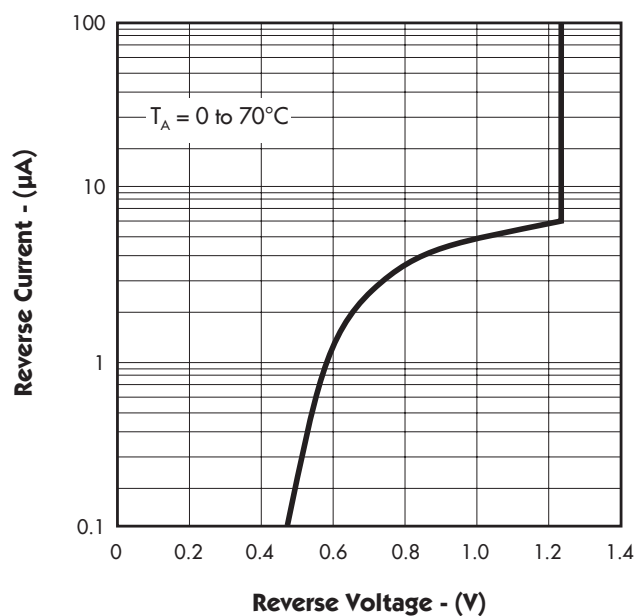


FIGURE 3. — FORWARD CHARACTERISTICS

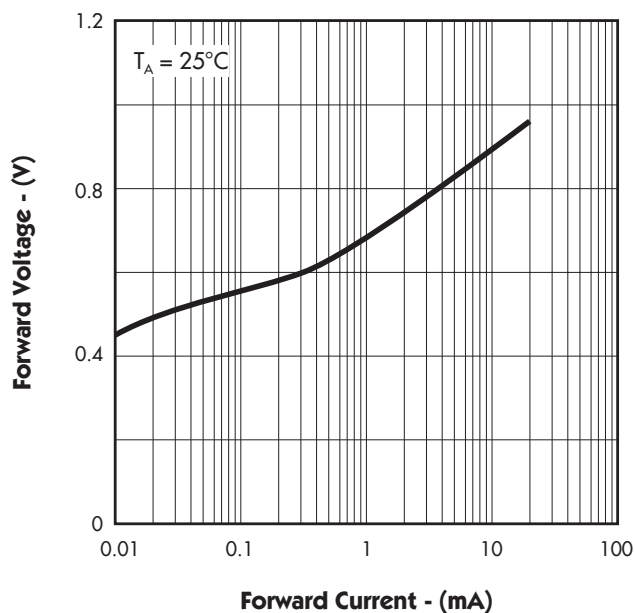
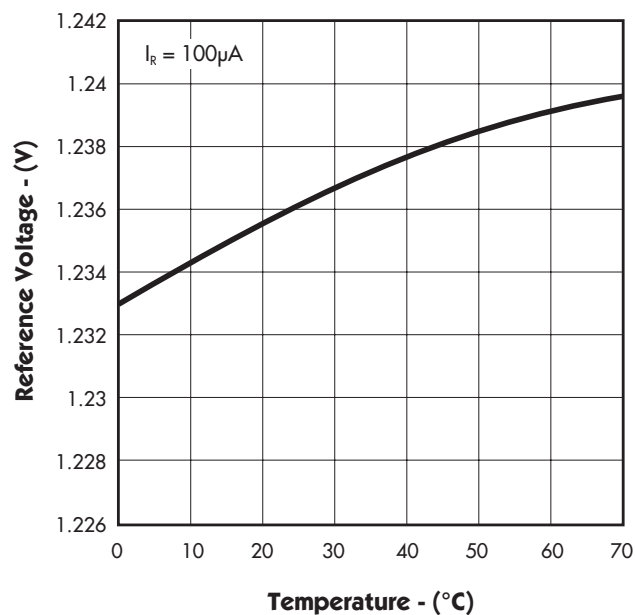


FIGURE 4. — TEMPERATURE DRIFT



## 1.2 &amp; 2.5V MICROPOWER VOLTAGE REFERENCE

## PRODUCTION DATA SHEET

## CHARACTERISTIC CURVES — LM385/385B-1.2V

FIGURE 5. — REVERSE VOLTAGE CHANGE

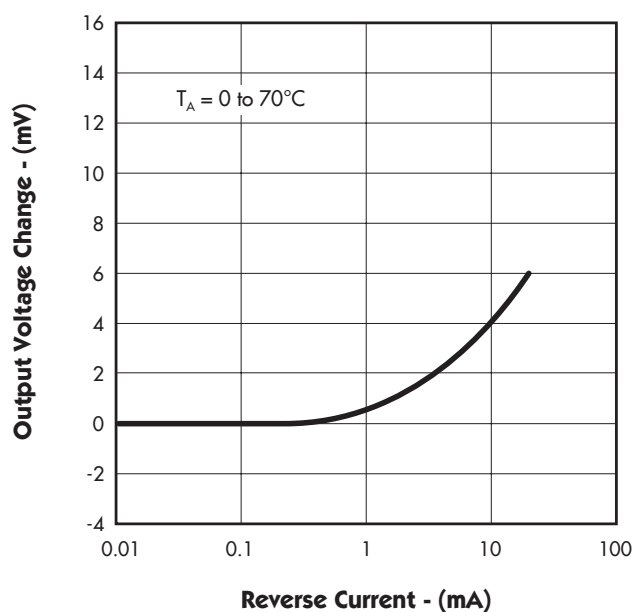


FIGURE 6. — REVERSE DYNAMIC IMPEDANCE

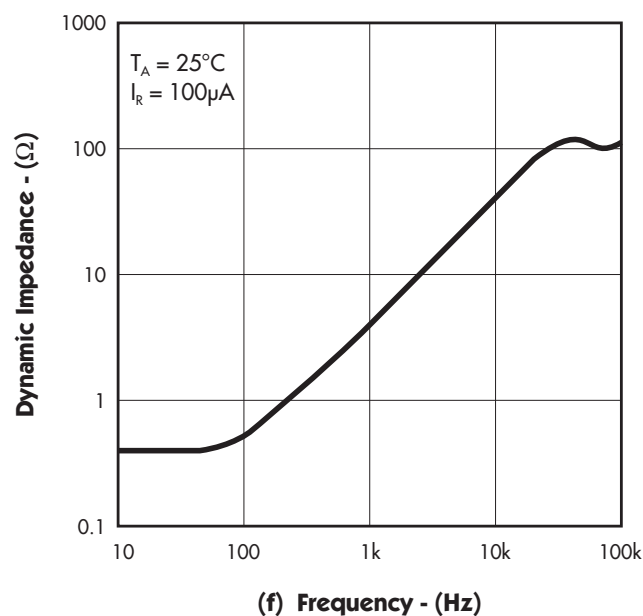
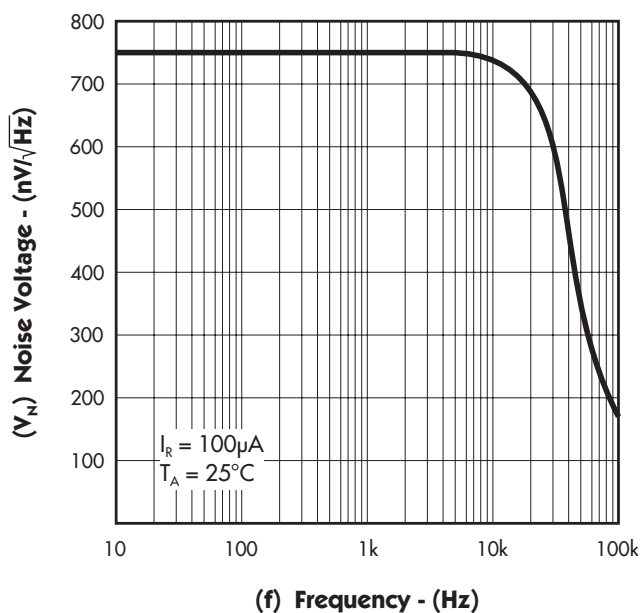


FIGURE 7. — NOISE VOLTAGE



#### CHARACTERISTIC CURVES — LM385/385B-2.5V

FIGURE 8. — RESPONSE TIME

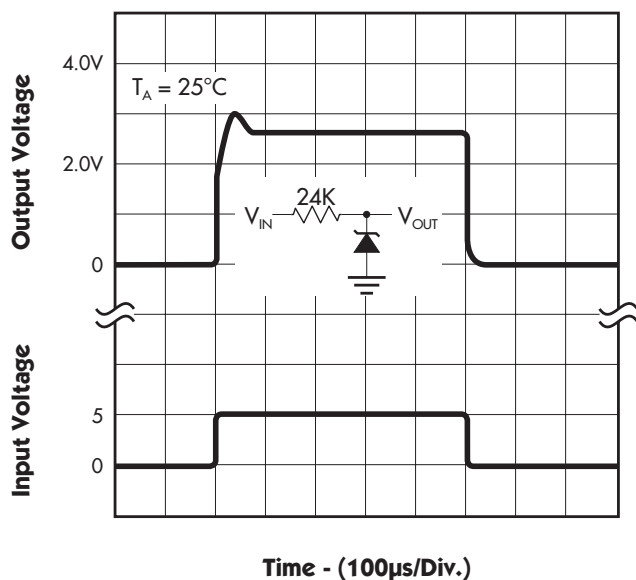


FIGURE 9. — REVERSE CHARACTERISTICS

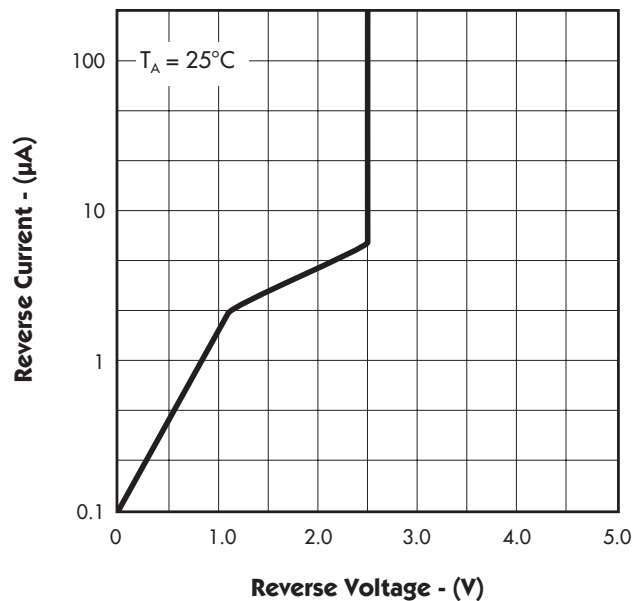


FIGURE 10. — FORWARD CHARACTERISTICS

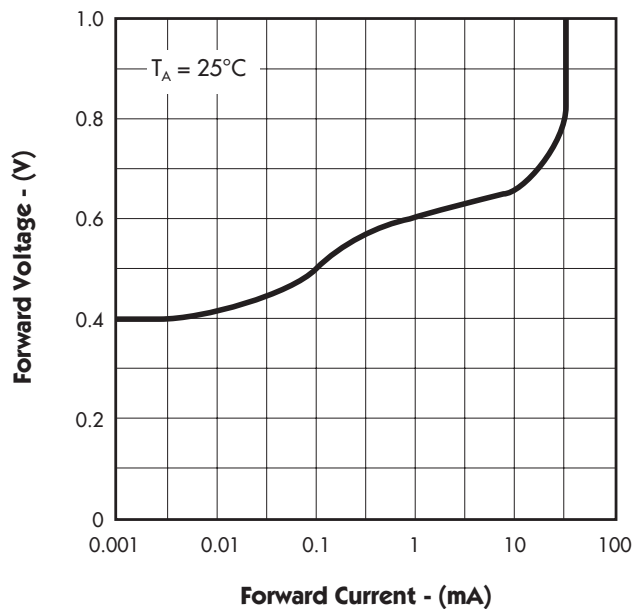
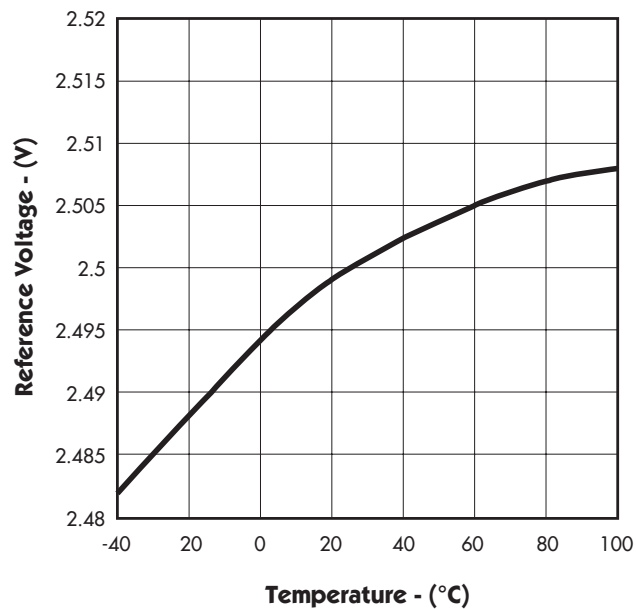


FIGURE 11. — TEMPERATURE DRIFT



## 1.2 &amp; 2.5V MICROPOWER VOLTAGE REFERENCE

## PRODUCTION DATA SHEET

## CHARACTERISTIC CURVES — LM385/385B-2.5V

FIGURE 12. — REVERSE DYNAMIC IMPEDANCE

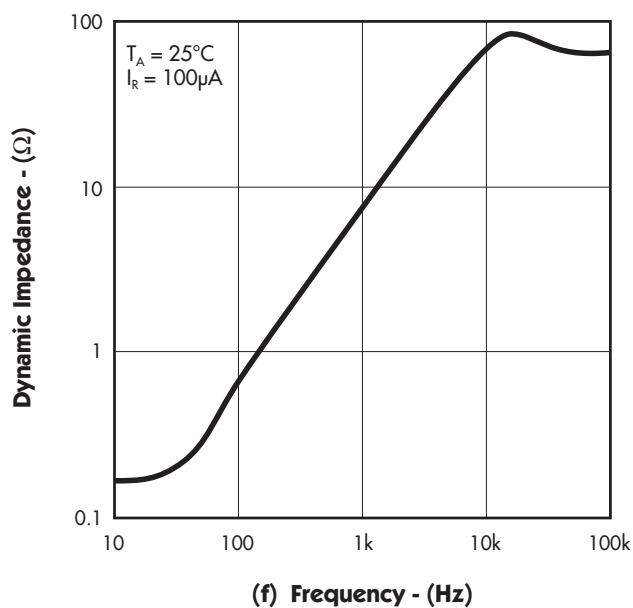


FIGURE 13. — NOISE VOLTAGE

