

## Micropower Voltage Reference Diodes

The LM385 series are micropower two-terminal bandgap voltage regulator diodes. Designed to operate over a wide current range of 10  $\mu\text{A}$  to 20 mA, these devices feature exceptionally low dynamic impedance, low noise and stable operation over time and temperature. Tight voltage tolerances are achieved by on-chip trimming. The large dynamic operating range enables these devices to be used in applications with widely varying supplies with excellent regulation. Extremely low operating current make these devices ideal for micropower circuitry like portable instrumentation, regulators and other analog circuitry where extended battery life is required.

The LM385 is also available in a surface mount plastic package in voltages of 1.235 V and 2.500 V.

### Features

- Operating Current from 10  $\mu\text{A}$  to 20 mA
- 1.0%, 1.5%, 2.0% and 3.0% Initial Tolerance Grades
- Low Temperature Coefficient
- 1.0  $\Omega$  Dynamic Impedance
- Surface Mount Package Available
- Pb-Free Packages are Available

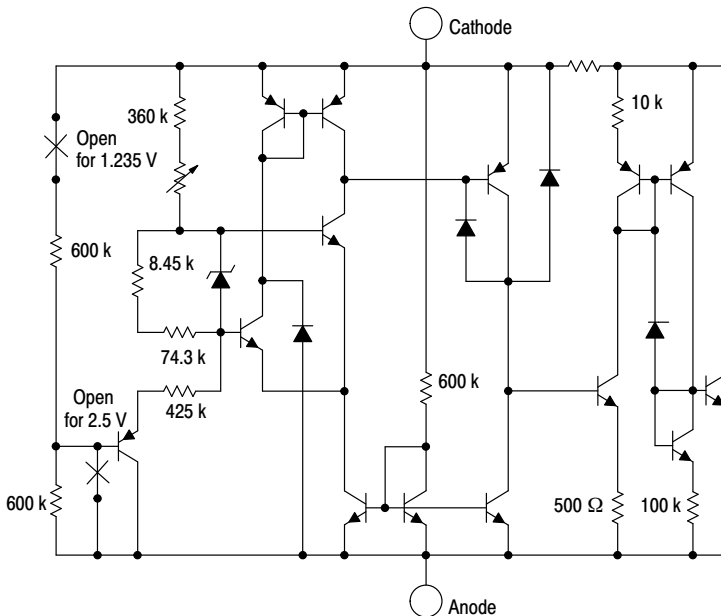
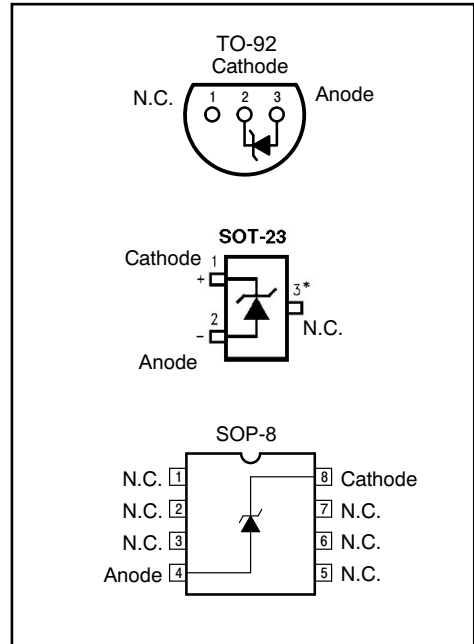
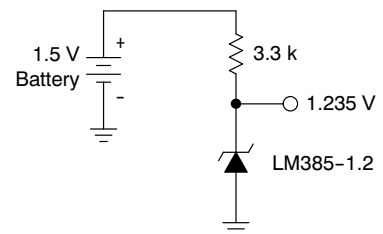


Figure 1. Representative Schematic Diagram



### Standard Application



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

**MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

Rating	Symbol	Value	Unit
Reverse Current	$I_R$	30	mA
Forward Current	$I_F$	10	mA
Operating Ambient Temperature Range LM385	$T_A$	0 to +70	$^\circ\text{C}$
Operating Junction Temperature	$T_J$	+150	$^\circ\text{C}$
Storage Temperature Range	$T_{\text{stg}}$	-65 to +150	$^\circ\text{C}$
Electrostatic Discharge Sensitivity (ESD) Human Body Model (HBM) Machine Model (MM) Charged Device Model (CDM)	ESD	4000 400 2000	V

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

Characteristic	Symbol	LM385			Unit
		Min	Typ	Max	
Reverse Breakdown Voltage ( $I_{R\text{min}} \leq I_R \leq 20 \text{ mA}$ ) LM385-1.2 $T_A = T_{\text{low}}$ to $T_{\text{high}}$ (Note 1)	$V_{(\text{BR})R}$	1.223 1.210 1.205 1.192	1.235 - 1.235 -	1.247 1.260 1.260 1.273	V
Minimum Operating Current $T_A = 25^\circ\text{C}$ $T_A = T_{\text{low}}$ to $T_{\text{high}}$ (Note 1)	$I_{R\text{min}}$	-	8.0 -	15 20	$\mu\text{A}$
Reverse Breakdown Voltage Change with Current $I_{R\text{min}} \leq I_R \leq 1.0 \text{ mA}$ , $T_A = +25^\circ\text{C}$ $T_A = T_{\text{low}}$ to $T_{\text{high}}$ (Note 1) $1.0 \text{ mA} \leq I_R \leq 20 \text{ mA}$ , $T_A = +25^\circ\text{C}$ $T_A = T_{\text{low}}$ to $T_{\text{high}}$ (Note 1)	$\Delta V_{(\text{BR})R}$	- - - -	- - - -	1.0 1.5 20 25	mV
Reverse Dynamic Impedance $I_R = 100 \mu\text{A}$ , $T_A = +25^\circ\text{C}$	Z	-	0.6	-	$\Omega$
Average Temperature Coefficient $10 \mu\text{A} \leq I_R \leq 20 \text{ mA}$ , $T_A = T_{\text{low}}$ to $T_{\text{high}}$ (Note 1)	$\Delta V_{(\text{BR})}/\Delta T$	-	80	-	ppm/ $^\circ\text{C}$
Wideband Noise (RMS) $I_R = 100 \mu\text{A}$ , $10 \text{ Hz} \leq f \leq 10 \text{ kHz}$	n	-	60	-	$\mu\text{V}$
Long Term Stability $I_R = 100 \mu\text{A}$ , $T_A = +25^\circ\text{C} \pm 0.1^\circ\text{C}$	S	-	20	-	ppm/kHR
Reverse Breakdown Voltage ( $I_{R\text{min}} \leq I_R \leq 20 \text{ mA}$ ) LM385-2.5 $T_A = T_{\text{low}}$ to $T_{\text{high}}$ (Note 1)	$V_{(\text{BR})R}$	2.462 2.436 2.425 2.400	2.5 - 2.5 -	2.538 2.564 2.575 2.600	V
Minimum Operating Current $T_A = 25^\circ\text{C}$ $T_A = T_{\text{low}}$ to $T_{\text{high}}$ (Note 1)	$I_{R\text{min}}$	- -	13 -	20 30	$\mu\text{A}$

$T_{\text{low}} = 0^\circ\text{C}$  for LM385-1.2, LM385B-1.2, LM385-2.5, LM385B-2.5  
 $T_{\text{high}} = +70^\circ\text{C}$  for LM385-1.2, LM385B-1.2, LM385-2.5, LM385B-2.5

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

Characteristic	Symbol	LM385			Unit
		Min	Typ	Max	
Reverse Breakdown Voltage Change with Current $I_{Rmin} \leq I_R \leq 1.0 \text{ mA}$ , $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to $T_{high}$ (Note 2) $1.0 \text{ mA} \leq I_R \leq 20 \text{ mA}$ , $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to $T_{high}$ (Note 2)	$\Delta V_{(BR)R}$	-	-	2.0 2.5 20 25	mV
Reverse Dynamic Impedance $I_R = 100 \mu\text{A}$ , $T_A = +25^\circ\text{C}$	Z	-	0.6	-	$\Omega$
Average Temperature Coefficient $20 \mu\text{A} \leq I_R \leq 20 \text{ mA}$ , $T_A = T_{low}$ to $T_{high}$ (Note 2)	$\Delta V_{(BR)}/\Delta T$	-	80	-	ppm/ $^\circ\text{C}$
Wideband Noise (RMS) $I_R = 100 \mu\text{A}$ , $10 \text{ Hz} \leq f \leq 10 \text{ kHz}$	n	-	120	-	$\mu\text{V}$
Long Term Stability $I_R = 100 \mu\text{A}$ , $T_A = +25^\circ\text{C} \pm 0.1^\circ\text{C}$	S	-	20	-	ppm/kHR

$T_{low} = 0^\circ\text{C}$  for LM385-1.2, LM385B-1.2, LM385-2.5, LM385B-2.5  
 $T_{high} = +70^\circ\text{C}$  for LM385-1.2, LM385B-1.2, LM385-2.5, LM385B-2.5

TYPICAL PERFORMANCE CURVES FOR **Im385**

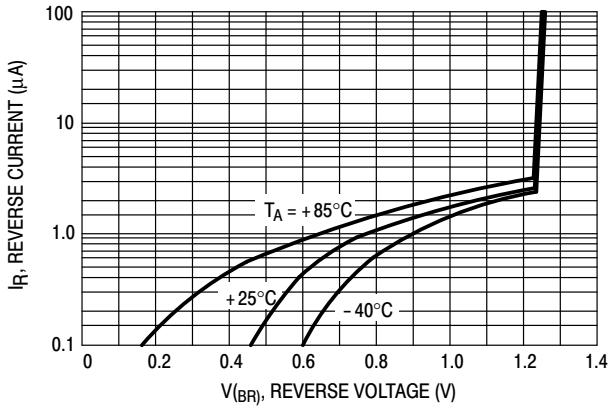


Figure 2. Reverse Characteristics

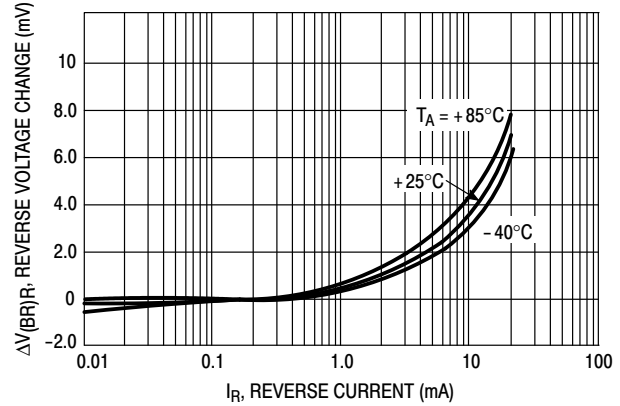


Figure 3. Reverse Characteristics

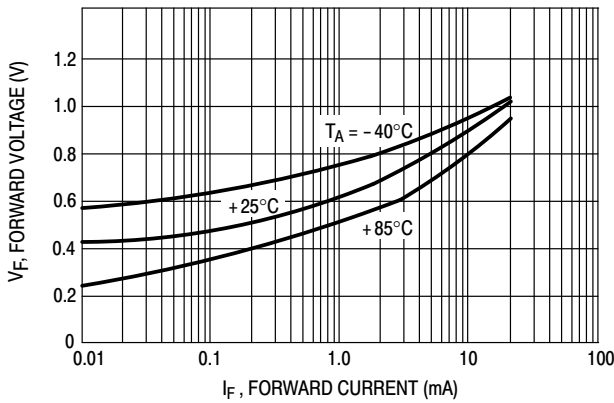


Figure 4. Forward Characteristics

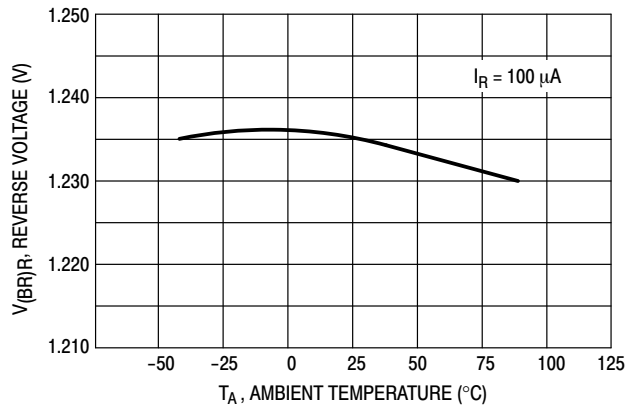


Figure 5. Temperature Drift

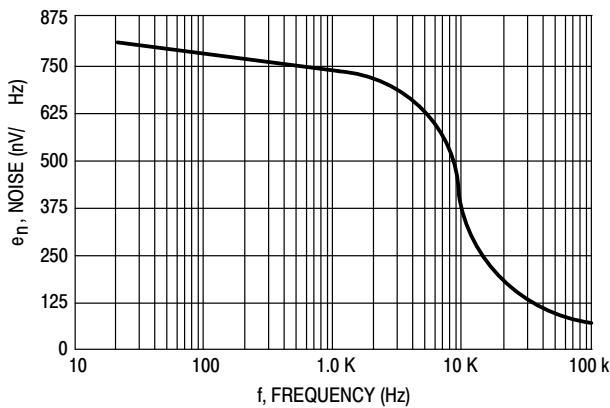


Figure 6. Noise Voltage

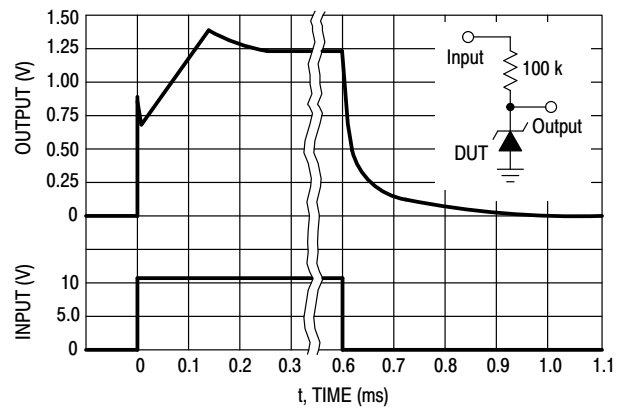


Figure 7. Response Time

TYPICAL PERFORMANCE CURVES FOR LM385-2.5

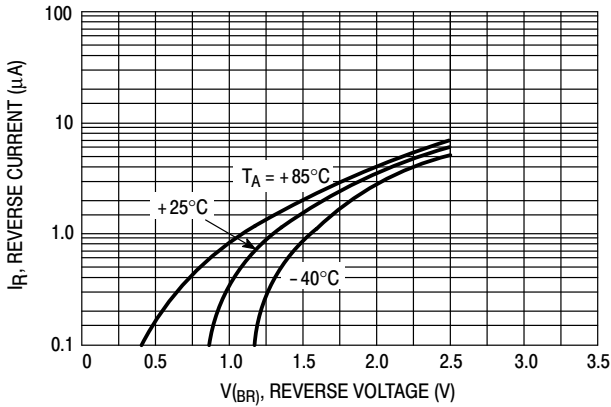


Figure 8. Reverse Characteristics

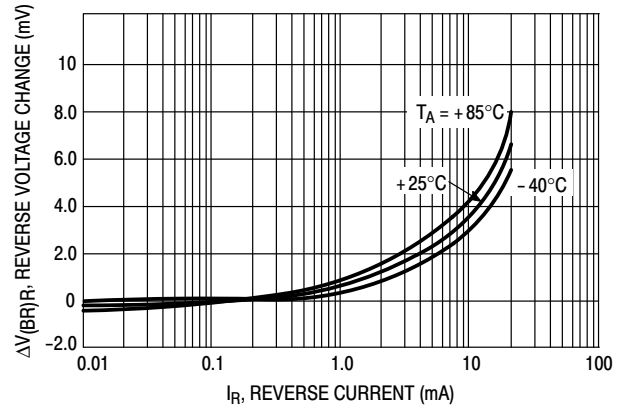


Figure 9. Reverse Characteristics

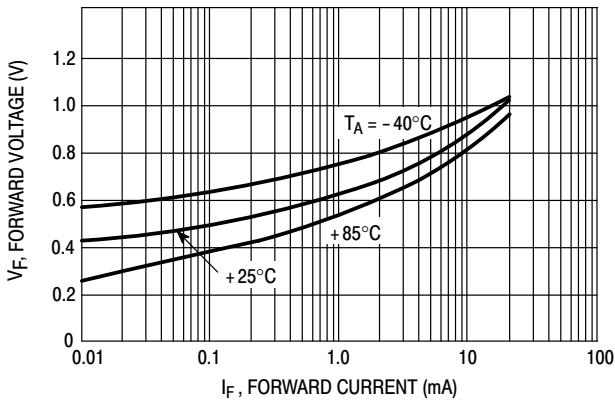


Figure 10. Forward Characteristics

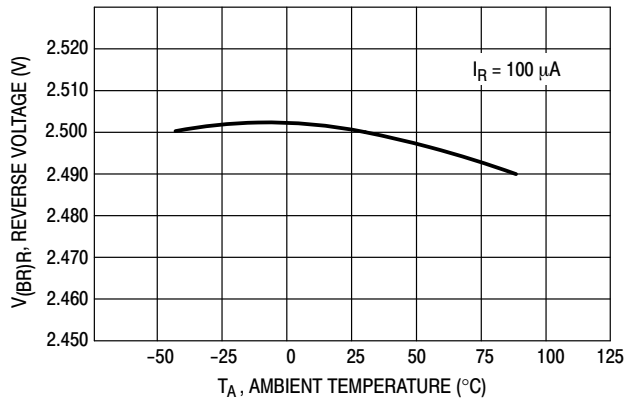


Figure 11. Temperature Drift

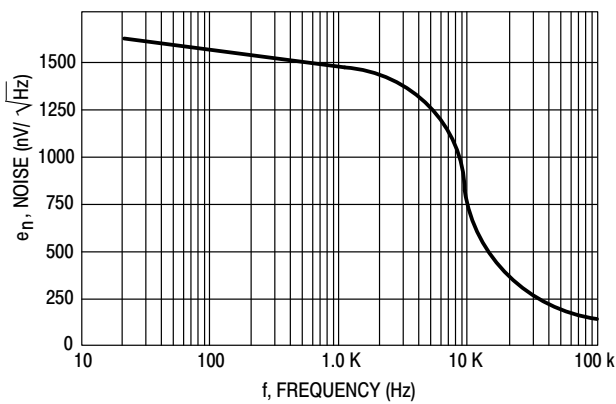


Figure 12. Noise Voltage

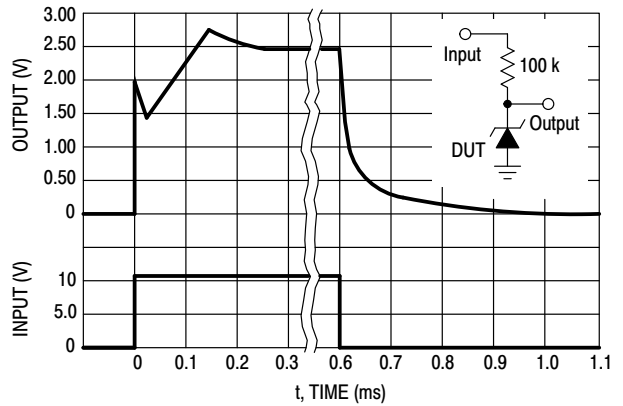


Figure 13. Response Time

## Important statement:

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