LM285
LM385, B

Micropower Voltage Reference Diodes

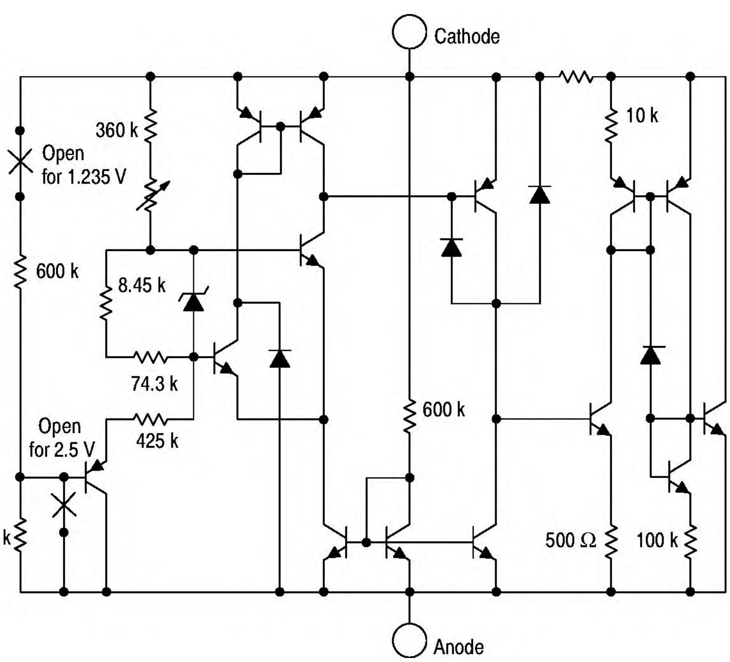
The LM285/LM385 series are micropower two–terminal bandgap voltage regulator diodes. Designed to operate over a wide current range of 10 μA to 20 mA, these devices feature exceptionally low dynamic impedance, low noise and stable operation over time and temperature. Tight voltage tolerances are achieved 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 LM285/LM385 series are packaged in a low cost TO–226AA plastic case and are available in two voltage versions of 1.235 and 2.500 V as denoted by the device suffix (see Ordering Information table). The LM285 is specified over a –40°C to +85°C temperature range while the LM385 is rated from 0°C to +70°C.

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

- Operating Current from 10 μA to 20 mA
- 1.0%, 1.5%, 2.0% and 3.0% Initial Tolerance Grades
- Low Temperature Coefficient
- 1.0 Ω Dynamic Impedance
- Surface Mount Package Available

Representative Schematic Diagram

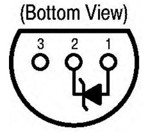


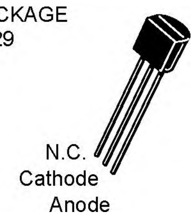
MICROPOWER VOLTAGE REFERENCE DIODES

SEMICONDUCTOR TECHNICAL DATA

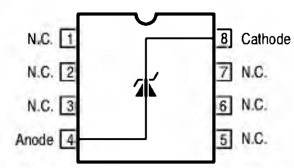
Z SUFFIX
PLASTIC PACKAGE
CASE 29

(Bottom View)

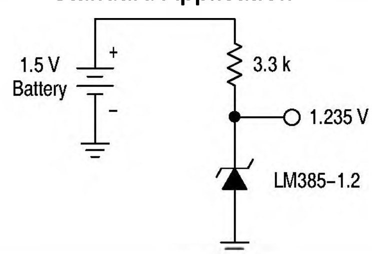




D SUFFIX
PLASTIC PACKAGE
CASE 751
(SO–8)



Standard Application



ORDERING INFORMATION

Device	Operating Temperature Range	Reverse Break–down Voltage	Tolerance
LM285D–1.2 LM285Z–1.2	T_A = –40° to +85°C	1.235 V	±1.0%
LM285D–2.5 LM285Z–2.5		2.500 V	±1.5%
LM385BD–1.2 LM385BZ–1.2	T_A = 0° to +70°C	1.235 V	±1.0%
LM385D–1.2 LM385Z–1.2		1.235 V	±2.0%
LM385BD–2.5 LM385BZ–2.5		2.500 V	±1.5%
LM385D–2.5 LM385Z–2.5		2.500 V	±3.0%

March, 2001 – Rev. 3
Publication Order Number:
LM285/D

MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted)

Rating	Symbol	Value	Unit
Reverse Current	I_R	30	mA
Forward Current	I_F	10	mA
Operating Ambient Temperature Range LM285 LM385	T_A	 – 40 to + 85 0 to +70	°C
Operating Junction Temperature	T_J	+ 150	°C
Storage Temperature Range	T_{stg}	– 65 to + 150	°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C, unless otherwise noted)

Characteristic	Symbol	LM285–1.2			LM385–1.2/LM385B–1.2			Unit
		Min	Typ	Max	Min	Typ	Max	
Reverse Breakdown Voltage ($I_{Rmin} \leqslant I_R \leqslant$ 20 mA) LM285–1.2/LM385B–1.2 $T_A = T_{low}$ to T_{high} (Note 1) LM385–1.2 $T_A = T_{low}$ to T_{high} (Note 1)	$V_{(BR)R}$	 1.223 1.200 – –	 1.235 – – –	 1.247 1.270 – –	 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°C $T_A = T_{low}$ to T_{high} (Note 1)	I_{Rmin}	 – –	 8.0 –	 10 20	 – –	 8.0 –	 15 20	μA
Reverse Breakdown Voltage Change with Current $I_{Rmin} \leqslant I_R \leqslant$ 1.0 mA, T_A = +25°C $T_A = T_{low}$ to T_{high} (Note 1) 1.0 mA $\leqslant I_R \leqslant$ 20 mA, T_A = +25°C $T_A = T_{low}$ to T_{high} (Note 1)	$\Delta V_{(BR)R}$	 – – – –	 – – – –	 1.0 1.5 10 20	 – – – –	 – – – –	 1.0 1.5 20 25	mV
Reverse Dynamic Impedance I_R = 100 μA, T_A = +25°C	Z		0.6	–	–	0.6	–	W
Average Temperature Coefficient 10 μA $\leqslant I_R \leqslant$ 20 mA, $T_A = T_{low}$ to T_{high} (Note 1)	$\Delta V_{(BR)}/\Delta T$	–	80	–	–	80	–	ppm/°C
Wideband Noise (RMS) I_R = 100 μA, 10 Hz $\leqslant$ f $\leqslant$ 10 kHz	n	–	60	–	–	60	–	μV
Long Term Stability I_R = 100 μA, T_A = +25°C ± 0.1°C	S	–	20	–	–	20	–	ppm/ kHR

ELECTRICAL CHARACTERISTICS (T_A = 25°C, unless otherwise noted)

Characteristic	Symbol	LM285–2.5			LM385–2.5/LM385B–2.5			Unit
		Min	Typ	Max	Min	Typ	Max	
Reverse Breakdown Voltage ($I_{Rmin} \leq I_R \leq$ 20 mA)	$V_{(BR)R}$							V
LM285–2.5/LM385B–2.5		2.462	2.5	2.538	2.462	2.5	2.538	
$T_A = T_{low}$ to T_{high} (Note 1)		2.415	–	2.585	2.436	–	2.564	
LM385–2.5		–	–	–	2.425	2.5	2.575	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	–	2.400	–	2.600	
Minimum Operating Current	I_{Rmin}							μA
T_A = 25°C		–	13	20	–	13	20	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	30	–	–	30	
Reverse Breakdown Voltage Change with Current	$\Delta V_{(BR)R}$							mV
$I_{Rmin} \leq I_R \leq$ 1.0 mA, T_A = +25°C		–	–	1.0	–	–	2.0	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	1.5	–	–	2.5	
1.0 mA $\leq I_R \leq$ 20 mA, T_A = +25°C		–	–	10	–	–	20	
$T_A = T_{low}$ to T_{high} (Note 1)		–	–	20	–	–	25	
Reverse Dynamic Impedance I_R = 100 μA, T_A = +25°C	Z		0.6	–	–	0.6	–	W
Average Temperature Coefficient 20 μA $\leq I_R \leq$ 20 mA, $T_A = T_{low}$ to T_{high} (Note 1)	$\Delta V_{(BR)}/\Delta T$	–	80	–	–	80	–	ppm/°C
Wideband Noise (RMS) I_R = 100 μA, 10 Hz $\leq$ f $\leq$ 10 kHz	n	–	120	–	–	120	–	μV
Long Term Stability I_R = 100 μA, T_A = +25°C ± 0.1°C	S	–	20	–	–	20	–	ppm/ kHR

NOTES: 1. T_{low} = – 40°C for LM285–1.2, LM285–2.5
= 0°C for LM385–1.2, LM385B–1.2, LM385–2.5, LM385B–2.5

T_{high} = +85°C for LM285–1.2, LM285–2.5
= +70°C for LM385–1.2, LM385B–1.2, LM385–2.5, LM385B–2.5

TYPICAL PERFORMANCE CURVES FOR LM285–1.2/385–1.2/385B–1.2

Figure 1. Reverse Characteristics

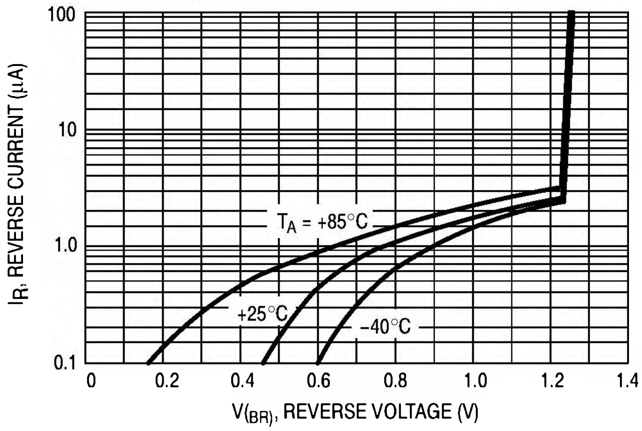


Figure 2. Reverse Characteristics

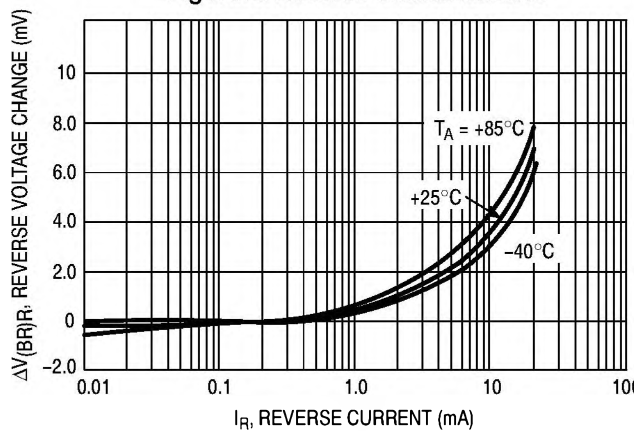


Figure 3. Forward Characteristics

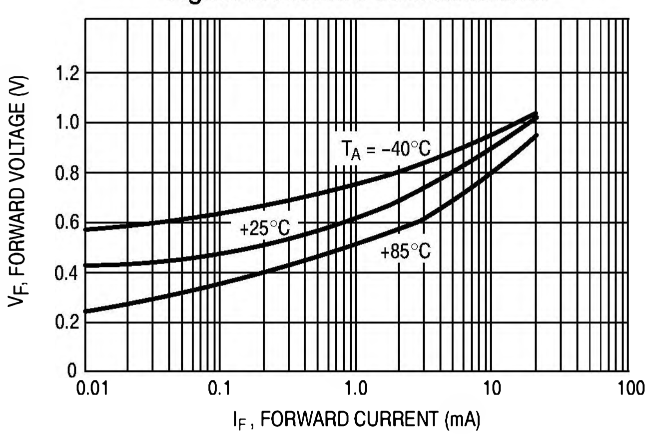


Figure 4. Temperature Drift

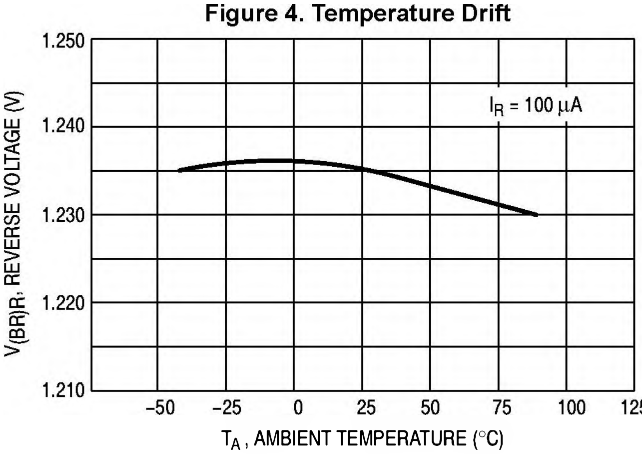


Figure 5. Noise Voltage

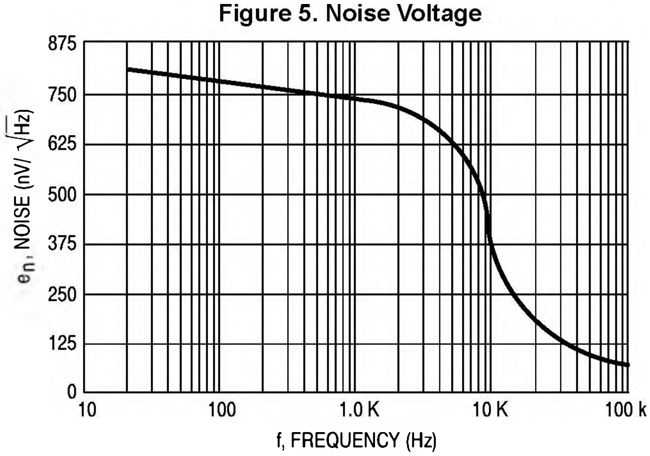
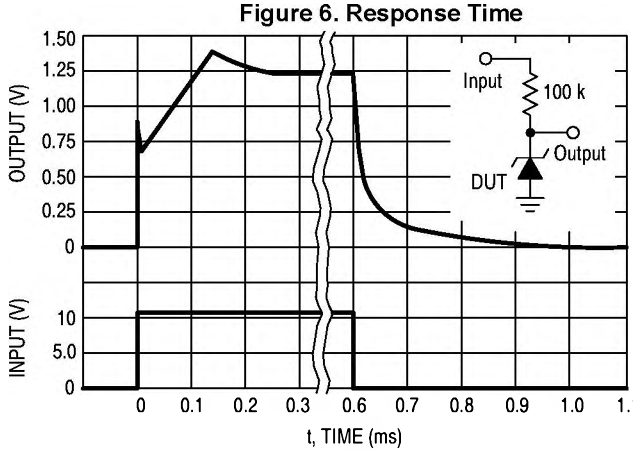


Figure 6. Response Time



TYPICAL PERFORMANCE CURVES FOR LM285–2.5/385–2.5/385B–2.5

Figure 7. Reverse Characteristics

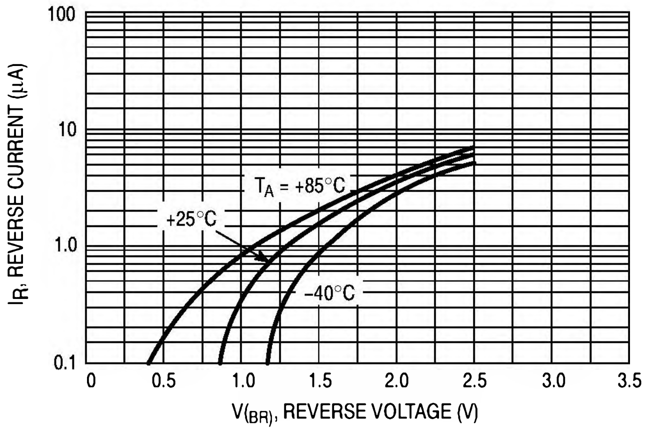


Figure 8. Reverse Characteristics

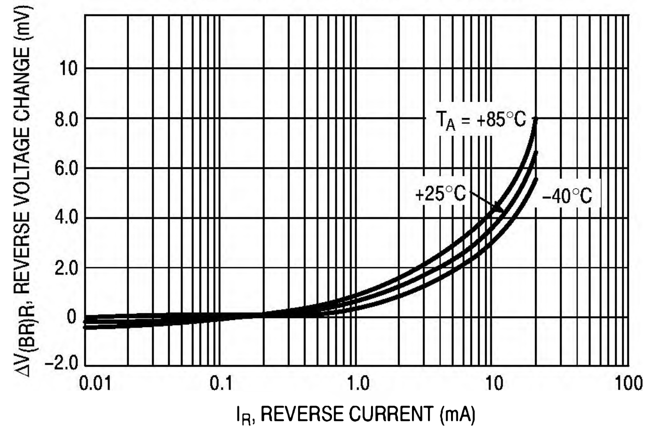


Figure 9. Forward Characteristics

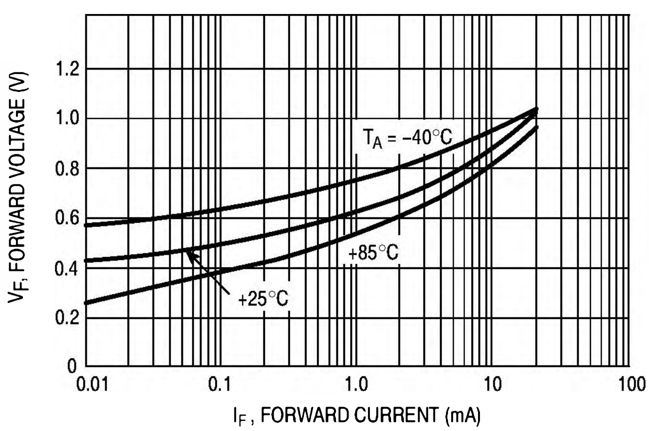


Figure 10. Temperature Drift

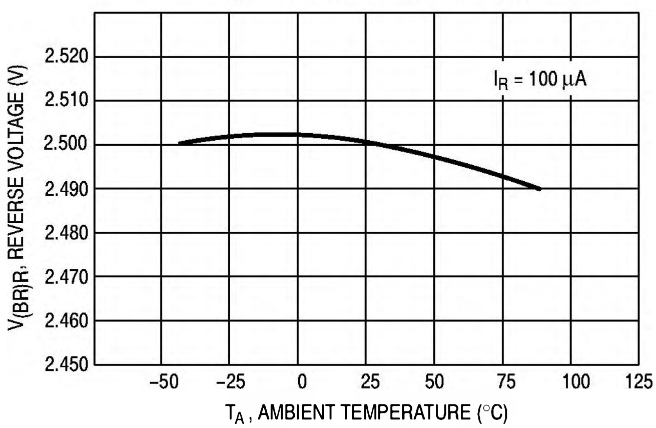


Figure 11. Noise Voltage

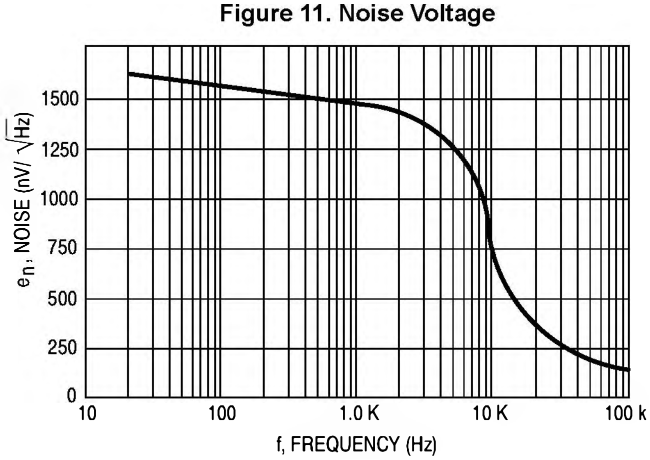


Figure 12. Response Time