

## LOW POWER, BANDGAP VOLTAGE REFERENCES

### FEATURES

- Output Tolerance ..... 1% or 2%
- Output Voltage Option
  - LM285/385-1.2V ..... 1.235V
  - LM285/385-2.5V ..... 2.5V
- Wide Operating Current Range
  - LM285/385-1.2V ..... 15 $\mu$ A to 20mA
  - LM285/385-2.5V ..... 20 $\mu$ A to 20mA
- Temperature Coefficient ..... 30ppm/ $^{\circ}$ C
- Dynamic Impedance ..... 0.6 $\Omega$
- TO-92-3 Plastic Package
- 8-Pin Plastic Narrow Body (SOIC) Package

### APPLICATIONS

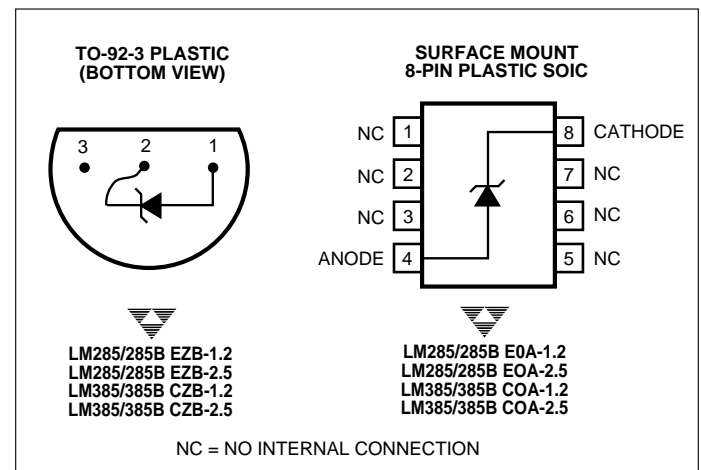
- ADC and DAC Reference
- Current Source Generation
- Threshold Detectors
- Power Supplies
- Multi-meters

### GENERAL DESCRIPTION

The LM285/385-1.2V (1.235V output) and LM285/385-2.5V (2.5V output) are bipolar, two-terminal, bandgap voltage references that offer precision performance without premium price. These devices do not require thin-film resistors, greatly lowering manufacturing complexity and cost.

A 30ppm/ $^{\circ}$ C output temperature coefficient and a 15 $\mu$ A to 20mA operating current range make these voltage references especially attractive for multimeter, data acquisition and telecommunications applications.

### PIN CONFIGURATIONS



### ORDERING INFORMATION

Part No.	Package	Temperature Range	Voltage	Tolerance
LM285BEOA-1.2	8-Pin SOIC	- 40 $^{\circ}$ C to +85 $^{\circ}$ C	1.2	1%
LM285BEOA-2.5	8-Pin SOIC	- 40 $^{\circ}$ C to +85 $^{\circ}$ C	2.5	1.5%
LM285BEZB-1.2	TO-92-3	- 40 $^{\circ}$ C to +85 $^{\circ}$ C	1.2	1%
LM285BEZB-2.5	TO-92-3	- 40 $^{\circ}$ C to +85 $^{\circ}$ C	2.5	1.5%
LM285EOA-1.2	8-Pin SOIC	- 40 $^{\circ}$ C to +85 $^{\circ}$ C	1.2	2%
LM285EOA-2.5	8-Pin SOIC	- 40 $^{\circ}$ C to +85 $^{\circ}$ C	2.5	3%
LM285EZB-1.2	TO-92-3	- 40 $^{\circ}$ C to +85 $^{\circ}$ C	1.2	2%
LM285EZB-2.5	TO-92-3	- 40 $^{\circ}$ C to +85 $^{\circ}$ C	2.5	3%
LM385BCOA-1.2	8-Pin SOIC	0 $^{\circ}$ C to +70 $^{\circ}$ C	1.2	1%
LM385BCOA-2.5	8-Pin SOIC	0 $^{\circ}$ C to +70 $^{\circ}$ C	2.5	1.5%
LM385BCZB-1.2	TO-92-3	0 $^{\circ}$ C to +70 $^{\circ}$ C	1.2	1%
LM385BCZB-2.5	TO-92-3	0 $^{\circ}$ C to +70 $^{\circ}$ C	2.5	1.5%
LM385COA-1.2	8-Pin SOIC	0 $^{\circ}$ C to +70 $^{\circ}$ C	1.2	2%
LM385COA-2.5	8-Pin SOIC	0 $^{\circ}$ C to +70 $^{\circ}$ C	2.5	3%
LM385CZB-1.2	TO-92-3	0 $^{\circ}$ C to +70 $^{\circ}$ C	1.2	2%
LM385CZB-2.5	TO-92-3	0 $^{\circ}$ C to +70 $^{\circ}$ C	2.5	3%

**LM285/285B-1.2V**  
**LM285/285B-2.5V**  
**LM385/385B-1.2V**  
**LM385/385B-2.5V**

**LOW POWER, BANDGAP  
VOLTAGE REFERENCES**

**ABSOLUTE MAXIMUM RATINGS\***

Forward Current .....	+10mA
Reverse Current .....	+30mA
Storage Temperature Range .....	– 65°C to +150°C
Operating Temperature Range	
TO-92 Package .....	– 40°C to +85°C
Surface Mount Package .....	– 40°C to +85°C

Lead Temperature (Soldering, 10 sec)

TO-92 Package ..... +300°C

Surface Mount Package ..... +300°C

Power Dissipation

Limited by Forward/Reverse Current

\*Functional operation above the absolute maximum stress ratings is not implied.

**ELECTRICAL CHARACTERISTICS:**  $T_A = +25^\circ\text{C}$ , unless otherwise specified.

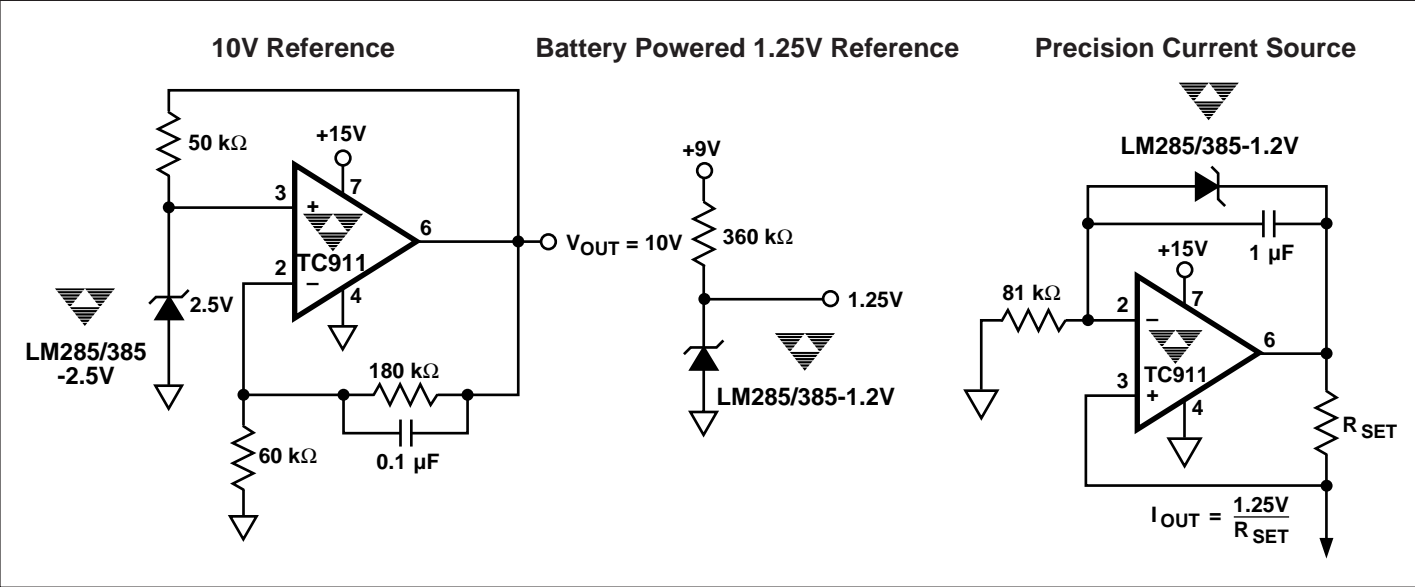
Symbol	Parameter	Test Conditions	LM285 / LM285B-1.2			LM385 / LM385B-1.2			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{(BR)R}$	Reverse Breakdown Voltage LM285B-1.2/LM385B-1.2 $T_A = T_{low}$ to $T_{high}$ (Note 1) LM285-1.2V/LM385-1.2V $T_A = T_{low}$ to $T_{high}$ (Note 1)	$I_R \leq 20\text{mA}$	1.223 1.200 1.205 1.192	1.235 — 1.235 —	1.247 1.270 1.260 1.273	1.223 1.210 1.205 1.192	1.235 — 1.235 —	1.247 1.260 1.260 1.273	V
$I_{RMIN}$	Minimum Operating Current $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to $T_{high}$ (Note 1)		— —	8.0 —	15 20	— —	8.0 —	15 20	$\mu\text{A}$
$\Delta V_{(BR)R}$	Reverse Breakdown Voltage Change with Current $I_{Rmin} = I_R = 1.0\text{mA}$ , $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to $T_{high}$ (Note 1) $1.0\text{mA} = I_R = 20\text{mA}$ , $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to $T_{high}$ (Note 1)		— — — —	— — — —	1.0 1.5 10 20	— — — —	— — — —	1.0 1.5 20 25	mV
Z	Reverse Dynamic Impedance	$I_R = 100\mu\text{A}$	—	0.6	—	—	0.6	—	$\Omega$
$\Delta V_{(BR)}/\Delta T$	Average Temperature Coefficient	$10\mu\text{A} \leq I_R \leq 20\text{mA}$	—	30	100	—	30	100	ppm/ $^\circ\text{C}$
S	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
Symbol	Parameter	Test Conditions	LM285 / LM285B-2.5			LM385 / LM385B-2.5			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{(BR)R}$	Reverse Breakdown Voltage LM285B-2.5/LM385B-2.5 $T_A = T_{low}$ to $T_{high}$ (Note 1) LM285-2.5V/LM385-2.5V $T_A = T_{low}$ to $T_{high}$ (Note 1)	$I_R = 20\text{mA}$	2.462 2.415 2.425 2.400	2.5 — 2.5 —	2.538 2.585 2.575 2.600	2.462 2.436 2.425 2.400	2.5 — 2.5 —	2.538 2.564 2.575 2.600	V
$I_{RMIN}$	Minimum Operating Current $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to $T_{high}$ (Note 1)		— —	13 —	20 30	— —	13 —	20 30	$\mu\text{A}$
$\Delta V_{(BR)R}$	Reverse Breakdown Voltage Change with Current $I_{Rmin} = I_R = 1.0\text{mA}$ , $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to $T_{high}$ (Note 1) $1.0\text{mA} = I_R = 20\text{mA}$ , $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to $T_{high}$ (Note 1)		— — — —	— — — —	1.0 1.5 10 20	— — — —	— — — —	2.0 2.5 20 25	mV
Z	Reverse Dynamic Impedance	$I_R = 100\mu\text{A}$	—	0.6	—	—	0.6	—	$\Omega$
$\Delta V_{(BR)}/\Delta T$	Average Temperature Coefficient	$20\mu\text{A} \leq I_R \leq 20\text{mA}$	—	30	100	—	30	100	ppm/ $^\circ\text{C}$
S	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.  $T_{low} = -40^\circ\text{C}$  for LM285-1.2, LM285-2.5, LM285B-1.2, LM285B-2.5  
 $0^\circ\text{C}$  for LM385-1.2, LM385B-1.2, LM385-2.5, LM385B-2.5  
 $T_{high} = +85^\circ\text{C}$  for LM285-1.2, LM285-2.5, LM285B-1.2, LM285B-2.5  
 $+70^\circ\text{C}$  for LM385-1.2, LM385B-1.2, LM385-2.5, LM385B-2.5

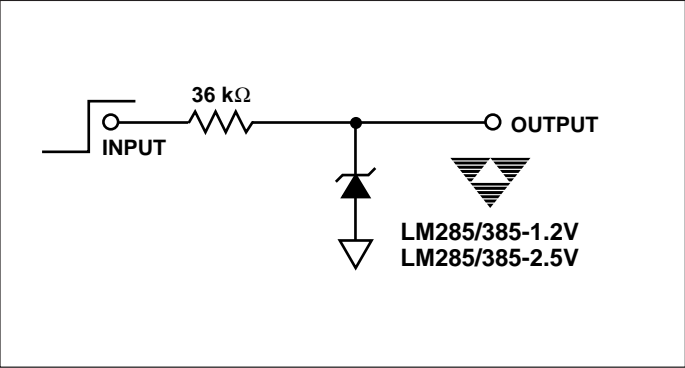
# LOW POWER, BANDGAP VOLTAGE REFERENCES

LM285/285B-1.2V  
LM285/285B-2.5V  
LM385/385B-1.2V  
LM385/385B-2.5V

## TYPICAL APPLICATIONS



## RESPONSE TIME TEST CIRCUIT



## TYPICAL CHARACTERISTICS

