

## LOW POWER, BAND-GAP 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

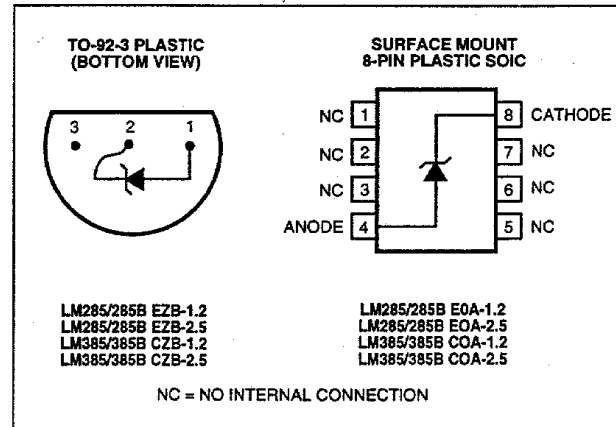
- ADC and DAC Reference
- Current Source Generation
- Threshold Detectors
- Power Supplies
- Multi-meters

### GENERAL DESCRIPTION

The LM285/385-1.2V (1.235V output) and LM285/385-2.5V (2.5V output) are bipolar, two-terminal, band-gap 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 LM385/385B-1.2V  
LM285/285B-2.5V LM385/385B-2.5V

## LOW POWER, BAND-GAP 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.

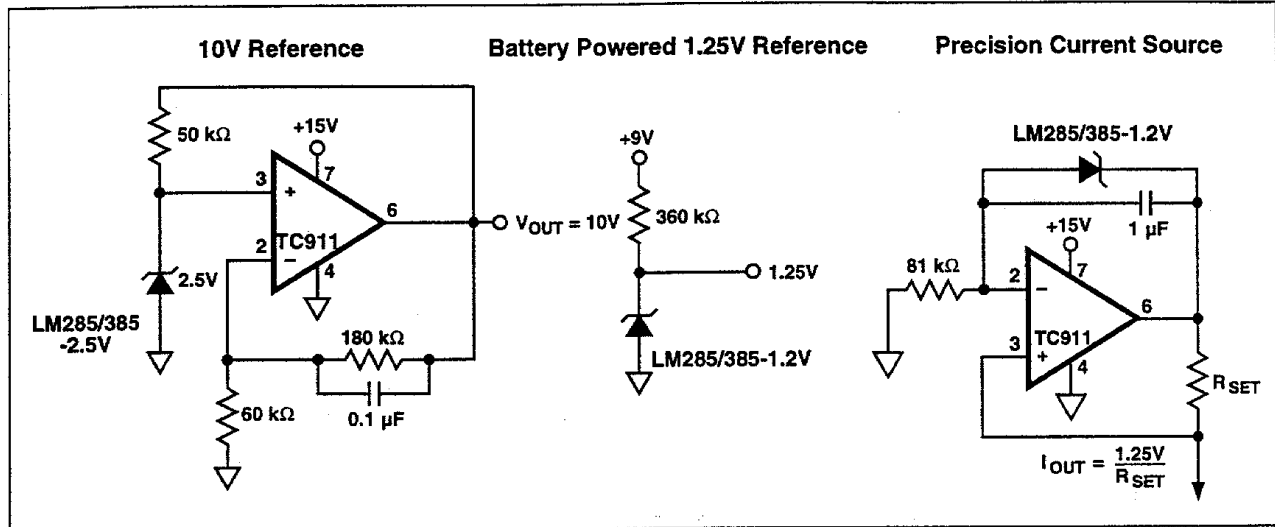
| Symbol                     | Parameter                                                                                                                                                                                                                                                             | Test Conditions                                                             | LM285 / LM285B-1.2      |                     |                         | LM385 / LM385B-1.2      |                     |                         | Unit                  |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------|---------------------|-------------------------|-------------------------|---------------------|-------------------------|-----------------------|
|                            |                                                                                                                                                                                                                                                                       |                                                                             | Min                     | Typ                 | Max                     | Min                     | Typ                 | Max                     |                       |
| $V_{(BR)R}$                | Reverse Breakdown Voltage<br>LM285B-1.2/LM385B-1.2<br>$T_A = T_{low}$ to $T_{high}$ (Note 1)<br>LM285-1.2V/LM385-1.2V<br>$T_A = T_{low}$ to $T_{high}$ (Note 1)                                                                                                       | $I_R \leq 20\text{mA}$                                                      | 1.223<br>1.200<br>1.205 | 1.235<br>—<br>1.235 | 1.247<br>1.270<br>1.260 | 1.223<br>1.210<br>1.205 | 1.235<br>—<br>1.235 | 1.247<br>1.260<br>1.260 | V                     |
| $I_{RMIN}$                 | Minimum Operating Current<br>$T_A = +25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$ (Note 1)                                                                                                                                                                      |                                                                             | —<br>—                  | 8.0<br>—            | 15<br>20                | —<br>—                  | 8.0<br>—            | 15<br>20                | $\mu\text{A}$         |
| $\Delta V_{(BR)R}$         | Reverse Breakdown Voltage<br>Change with Current<br>$I_{Rmin} = I_R = 1.0\text{mA}$ , $T_A = +25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$ (Note 1)<br>$1.0\text{mA} = I_R = 20\text{mA}$ , $T_A = +25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$ (Note 1) |                                                                             | —<br>—<br>—<br>—        | —<br>—<br>—<br>—    | 1.0<br>1.5<br>10<br>20  | —<br>—<br>—<br>—        | —<br>—<br>—<br>—    | 1.0<br>1.5<br>20<br>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                                                                                                                                                                                                                                                   | $I_R = 100\mu\text{A}$ ,<br>$T_A = +25^\circ\text{C} \pm 0.1^\circ\text{C}$ | —                       | 20                  | —                       | —                       | 20                  | —                       | ppm/kHR               |

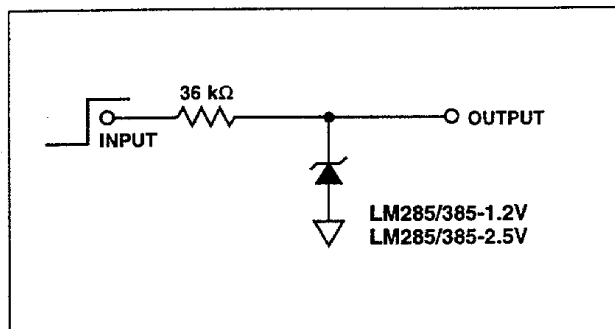
| Symbol                     | Parameter                                                                                                                                                                                                                                                             | Test Conditions                                                             | LM285 / LM285B-2.5               |                      |                                  | LM385 / LM385B-2.5               |                      |                                  | Unit                  |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|----------------------------------|----------------------|----------------------------------|----------------------------------|----------------------|----------------------------------|-----------------------|
|                            |                                                                                                                                                                                                                                                                       |                                                                             | Min                              | Typ                  | Max                              | Min                              | Typ                  | Max                              |                       |
| $V_{(BR)R}$                | Reverse Breakdown Voltage<br>LM285B-2.5/LM385B-2.5<br>$T_A = T_{low}$ to $T_{high}$ (Note 1)<br>LM285-2.5V/LM385-2.5V<br>$T_A = T_{low}$ to $T_{high}$ (Note 1)                                                                                                       | $I_R = 20\text{mA}$                                                         | 2.462<br>2.415<br>2.425<br>2.400 | 2.5<br>—<br>2.5<br>— | 2.538<br>2.585<br>2.575<br>2.600 | 2.462<br>2.436<br>2.425<br>2.400 | 2.5<br>—<br>2.5<br>— | 2.538<br>2.564<br>2.575<br>2.600 | V                     |
| $I_{RMIN}$                 | Minimum Operating Current<br>$T_A = +25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$ (Note 1)                                                                                                                                                                      |                                                                             | —<br>—                           | 13<br>—              | 20<br>30                         | —<br>—                           | 13<br>—              | 20<br>30                         | $\mu\text{A}$         |
| $\Delta V_{(BR)R}$         | Reverse Breakdown Voltage<br>Change with Current<br>$I_{Rmin} = I_R = 1.0\text{mA}$ , $T_A = +25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$ (Note 1)<br>$1.0\text{mA} = I_R = 20\text{mA}$ , $T_A = +25^\circ\text{C}$<br>$T_A = T_{low}$ to $T_{high}$ (Note 1) |                                                                             | —<br>—<br>—<br>—                 | —<br>—<br>—<br>—     | 1.0<br>1.5<br>10<br>20           | —<br>—<br>—<br>—                 | —<br>—<br>—<br>—     | 2.0<br>2.5<br>20<br>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                                                                                                                                                                                                                                                   | $I_R = 100\mu\text{A}$ ,<br>$T_A = +25^\circ\text{C} \pm 0.1^\circ\text{C}$ | —                                | 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

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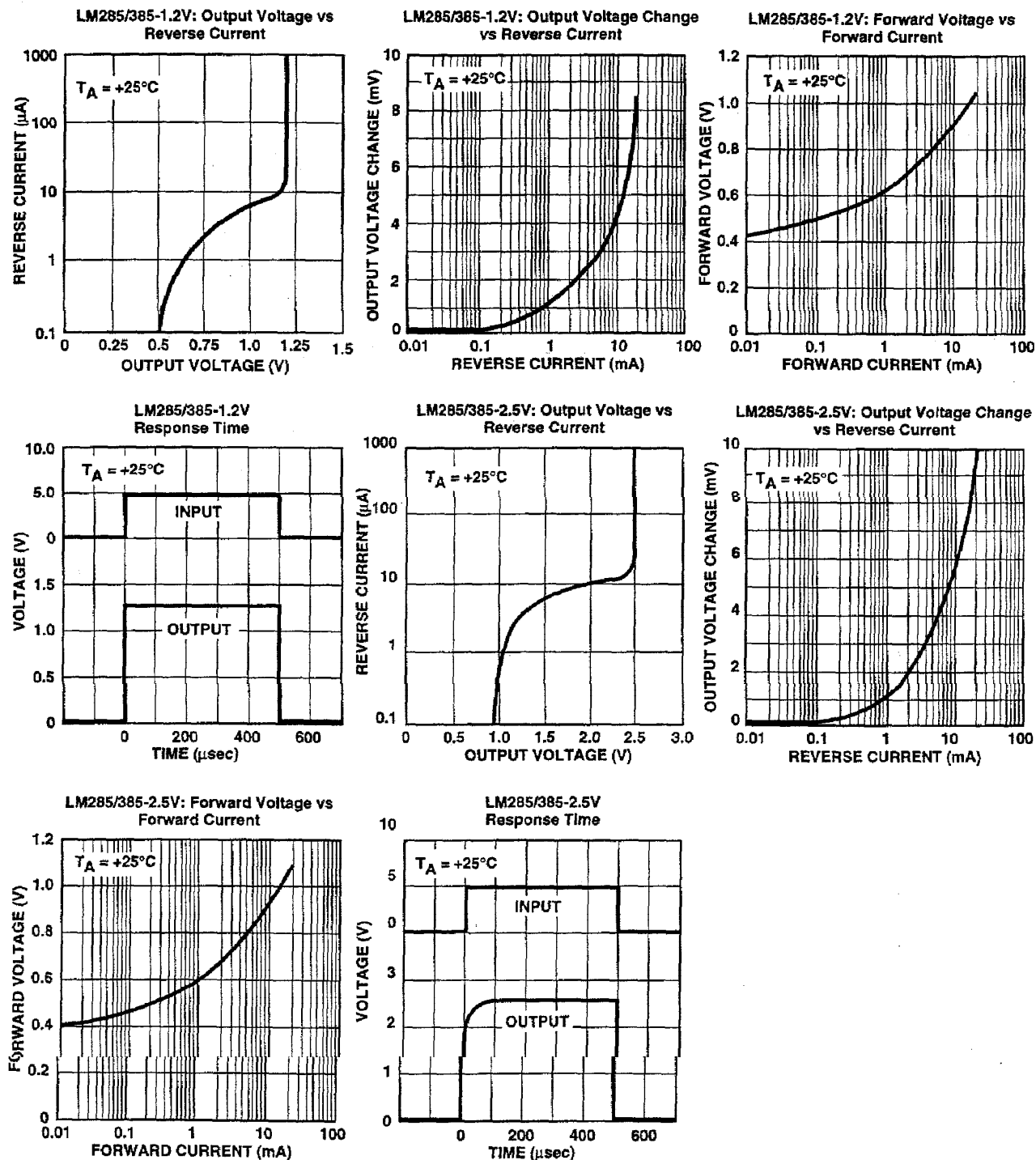
### RESPONSE TIME TEST CIRCUIT



### TYPICAL APPLICATIONS

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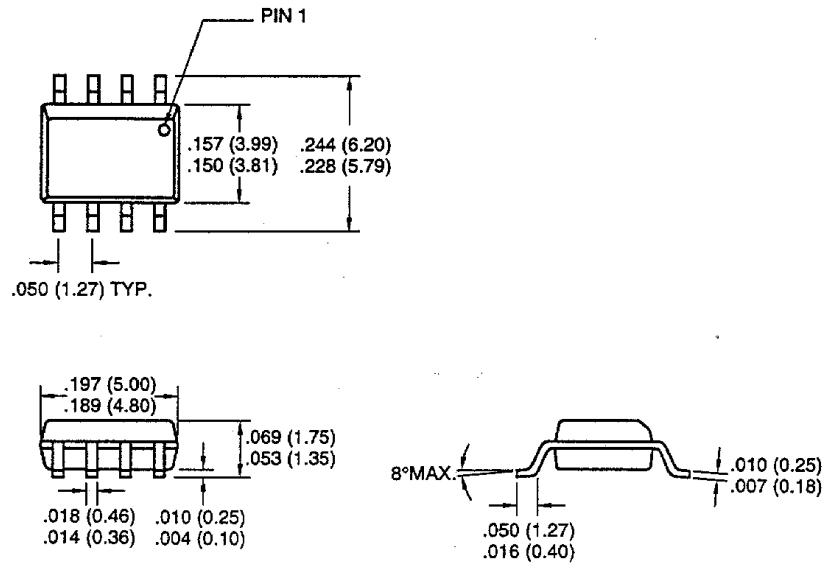
### TYPICAL CHARACTERISTICS CURVES



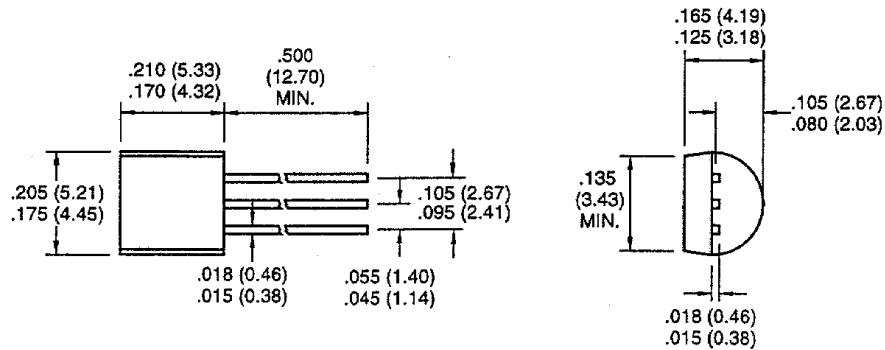
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## PACKAGE DIMENSIONS

### 8-Pin SOIC



### TO-92-3



Dimensions: inches (mm)

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

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## LOW POWER, BAND-GAP VOLTAGE REFERENCES

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### LIFE SUPPORT USAGE POLICY:

GMT's products are not authorized for use as critical components in life support devices or systems without the express written approval of the CEO of GMT. As used herein:

(a) Life support devices or systems are devices or systems which (1) are intended for surgical implant into the body; or (2) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user; and

(b) A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system.

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