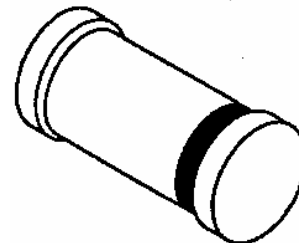


## DESCRIPTION

This surface mountable zener diode series is similar to the 1N3016 thru 1N3051 JEDEC registration in the DO-13 package except that it meets the surface mount DO-213AB outline. It is an ideal selection for applications of high density and low parasitic requirements. Due to its glass hermetic seal qualities and metallurgically enhanced internal construction, it is also well suited for high-reliability applications. This can be acquired by a source control drawing (SCD), or by ordering device types with MQ, MX, or MV prefix to part number for equivalent screening to JAN, JANTX or JANTXV.

## APPEARANCE



**DO-213AB**

**IMPORTANT:** For the most current data, consult MICROSEMI's website: <http://www.microsemi.com>

## FEATURES

- Leadless surface mount package equivalents to the JEDEC registered 1N3016 thru 1N3051 except with higher power rating of 1.5 Watts
- Ideal for high-density mounting
- Voltage range: 6.8 to 200 volts
- Hermetically sealed, double-slug glass construction
- Metallurgically enhanced contact construction.
- Options for screening in accordance with MIL-PRF-19500/115 for JAN, JANTX, JANTXV, and JANS with MQ, MX, MV, or MSP prefixes respectively for part numbers, e.g. MX1N3016BUR-1, MV1N3051BUR-1, etc.
- Axial lead "thru-hole" DO-13 packages per JEDEC registration available as 1N3016B thru 1N3051B (see separate data sheet with MIL-PRF-19500/115 qualification)
- RoHS Compliant devices available by adding "e3" suffix

## APPLICATIONS / BENEFITS

- Regulates voltage over a broad operating current and temperature range
- Wide selection from 6.8 to 200 V
- Tight voltage tolerances available
- Low reverse (leakage) currents
- Leadless package for surface mounting
- Ideal for high-density mounting
- Metallurgically enhanced internal contact design for greater reliability and lower thermal resistance
- Nonsensitive to ESD
- Hermetically sealed glass package
- Specified capacitance (see Figure 2)
- Inherently radiation hard as described in Microsemi MicroNote 050

## MAXIMUM RATINGS

- Power dissipation at 25°C: 1.5 watts (also see derating in Figure 1).
- Operating and Storage temperature: -65°C to +175°C
- Thermal Resistance: 40°C/W junction to end cap, or 120°C/W junction to ambient when mounted on FR4 PC board (1 oz Cu) with recommended footprint (see last page)
- Steady-State Power: 1.50 watts at end-cap temperature  $T_{EC} \leq 115^{\circ}\text{C}$ , or 1.25 watts at  $T_A = 25^{\circ}\text{C}$  when mounted on FR4 PC board and recommended footprint as described for thermal resistance (also see Figure 1)
- Forward voltage @200 mA: 1.2 volts (maximum)
- Solder Temperatures: 260°C for 10 s (max)

## MECHANICAL AND PACKAGING

- CASE: Hermetically sealed glass MELF package
- TERMINALS: Tin-lead or RoHS compliant annealed matte-Tin plating solderable per MIL-STD-750, method 2026
- POLARITY: Cathode indicated by band. Diode to be operated with the banded end positive with respect to the opposite end for Zener regulation
- MARKING: Cathode band only
- TAPE & REEL optional: Standard per EIA-481-1-A with 12 mm tape, 1500 per 7 inch reel or 5000 per 13 inch reel (add "TR" suffix to part number)
- WEIGHT: 0.05 grams
- See package dimensions on last page

**\*ELECTRICAL CHARACTERISTICS @ 25°C**

| INDUSTRY<br>PART<br>NUMBER<br>** | MICROSEMI<br>PART<br>NUMBER | NOMINAL<br>ZENER<br>VOLTAGE<br>V <sub>Z</sub> @ I <sub>ZT</sub><br>(NOTE 1) | ZENER<br>TEST<br>CURRENT<br>I <sub>ZT</sub> | MAXIMUM ZENER<br>IMPEDANCE<br>(Note 2) |                                   |     | MAXIMUM<br>ZENER<br>CURRENT<br>I <sub>ZM</sub> | MAXIMUM<br>REVERSE<br>LEAKAGE<br>CURRENT †<br>I <sub>R</sub> @ V <sub>R</sub> |       | TYPICAL<br>TEMP.COEFF<br>OF ZENER<br>VOLTAGE<br>α <sub>VZ</sub> |
|----------------------------------|-----------------------------|-----------------------------------------------------------------------------|---------------------------------------------|----------------------------------------|-----------------------------------|-----|------------------------------------------------|-------------------------------------------------------------------------------|-------|-----------------------------------------------------------------|
|                                  |                             |                                                                             |                                             | Z <sub>ZT</sub> @ I <sub>ZT</sub>      | Z <sub>ZK</sub> @ I <sub>ZK</sub> |     |                                                |                                                                               |       |                                                                 |
|                                  |                             | VOLTS                                                                       | mA                                          | OHMS                                   | OHMS                              | mA  | mA                                             | μA                                                                            | Volts | %/°C                                                            |
| 1N3016BUR-1                      | MLL3016B                    | 6.8                                                                         | 37                                          | 3.5                                    | 700                               | 1.0 | 210                                            | 5                                                                             | 5.2   | .040                                                            |
| 1N3017BUR-1                      | MLL3017B                    | 7.5                                                                         | 34                                          | 4.0                                    | 700                               | .5  | 187.5                                          | 5                                                                             | 5.7   | .045                                                            |
| 1N3018BUR-1                      | MLL3018B                    | 8.2                                                                         | 31                                          | 4.5                                    | 700                               | .5  | 172.5                                          | 5                                                                             | 6.2   | .048                                                            |
| 1N3019BUR-1                      | MLL3019B                    | 9.1                                                                         | 28                                          | 5                                      | 700                               | .5  | 157.5                                          | 5                                                                             | 6.9   | .050                                                            |
| 1N3020BUR-1                      | MLL3020B                    | 10                                                                          | 25                                          | 7                                      | 700                               | .25 | 142.5                                          | 5                                                                             | 7.6   | .055                                                            |
| 1N3021BUR-1                      | MLL3021B                    | 11                                                                          | 23                                          | 8                                      | 700                               | .25 | 127.5                                          | 1.0                                                                           | 8.4   | .060                                                            |
| 1N3022BUR-1                      | MLL3022B                    | 12                                                                          | 21                                          | 9                                      | 700                               | .25 | 120                                            | 1.0                                                                           | 9.1   | .065                                                            |
| 1N3023BUR-1                      | MLL3023B                    | 13                                                                          | 19                                          | 10                                     | 700                               | .25 | 111                                            | 0.5                                                                           | 9.9   | .065                                                            |
| 1N3024BUR-1                      | MLL3024B                    | 15                                                                          | 17                                          | 14                                     | 700                               | .25 | 94.5                                           | 0.5                                                                           | 11.4  | .070                                                            |
| 1N3025BUR-1                      | MLL3025B                    | 16                                                                          | 15.5                                        | 16                                     | 700                               | .25 | 90                                             | 0.5                                                                           | 12.2  | .070                                                            |
| 1N3026BUR-1                      | MLL3026B                    | 18                                                                          | 14.0                                        | 20                                     | 750                               | .25 | 78                                             | 0.5                                                                           | 13.7  | .075                                                            |
| 1N3027BUR-1                      | MLL3027B                    | 20                                                                          | 12.5                                        | 22                                     | 750                               | .25 | 70.5                                           | 0.5                                                                           | 15.2  | .075                                                            |
| 1N3028BUR-1                      | MLL3028B                    | 22                                                                          | 11.5                                        | 23                                     | 750                               | .25 | 64.5                                           | 0.5                                                                           | 16.7  | .080                                                            |
| 1N3029BUR-1                      | MLL3029B                    | 24                                                                          | 10.5                                        | 25                                     | 750                               | .25 | 60                                             | 0.5                                                                           | 18.2  | .080                                                            |
| 1N3030BUR-1                      | MLL3030B                    | 27                                                                          | 9.5                                         | 35                                     | 1000                              | .25 | 51                                             | 0.5                                                                           | 20.6  | .085                                                            |
| 1N3031BUR-1                      | MLL3031B                    | 30                                                                          | 8.5                                         | 40                                     | 1000                              | .25 | 46.5                                           | 0.5                                                                           | 22.8  | .085                                                            |
| 1N3032BUR-1                      | MLL3032B                    | 33                                                                          | 7.5                                         | 45                                     | 1000                              | .25 | 42                                             | 0.5                                                                           | 25.1  | .085                                                            |
| 1N3033BUR-1                      | MLL3033B                    | 36                                                                          | 7.0                                         | 50                                     | 1000                              | .25 | 39                                             | 0.5                                                                           | 27.4  | .085                                                            |
| 1N3034BUR-1                      | MLL3034B                    | 39                                                                          | 6.5                                         | 60                                     | 1000                              | .25 | 34.5                                           | 0.5                                                                           | 29.7  | .090                                                            |
| 1N3035BUR-1                      | MLL3035B                    | 40                                                                          | 6.0                                         | 70                                     | 1500                              | .25 | 31.5                                           | 0.5                                                                           | 32.7  | .090                                                            |
| 1N3036BUR-1                      | MLL3036B                    | 47                                                                          | 5.5                                         | 80                                     | 1500                              | .25 | 28.5                                           | 0.5                                                                           | 35.8  | .090                                                            |
| 1N3037BUR-1                      | MLL3037B                    | 51                                                                          | 5.0                                         | 95                                     | 1500                              | .25 | 27                                             | 0.5                                                                           | 38.8  | .090                                                            |
| 1N3038BUR-1                      | MLL3038B                    | 56                                                                          | 4.5                                         | 110                                    | 2000                              | .25 | 25.5                                           | 0.5                                                                           | 42.6  | .090                                                            |
| 1N3039BUR-1                      | MLL3039B                    | 62                                                                          | 4.0                                         | 125                                    | 2000                              | .25 | 22.5                                           | 0.5                                                                           | 47.1  | .090                                                            |
| 1N3040BUR-1                      | MLL3040B                    | 68                                                                          | 3.7                                         | 150                                    | 2000                              | .25 | 21                                             | 0.5                                                                           | 51.7  | .090                                                            |
| 1N3041BUR-1                      | MLL3041B                    | 75                                                                          | 3.3                                         | 175                                    | 2000                              | .25 | 18                                             | 0.5                                                                           | 56.0  | .090                                                            |
| 1N3042BUR-1                      | MLL3042B                    | 82                                                                          | 3.0                                         | 200                                    | 3000                              | .25 | 16.5                                           | 0.5                                                                           | 62.2  | .090                                                            |
| 1N3043BUR-1                      | MLL3043B                    | 91                                                                          | 2.8                                         | 250                                    | 3000                              | .25 | 15                                             | 0.5                                                                           | 69.2  | .090                                                            |
| 1N3044BUR-1                      | MLL3044B                    | 100                                                                         | 2.5                                         | 350                                    | 3000                              | .25 | 13.5                                           | 0.5                                                                           | 76.0  | .090                                                            |
| 1N3045BUR-1                      | MLL3045B                    | 110                                                                         | 2.3                                         | 450                                    | 4000                              | .25 | 12.45                                          | 0.5                                                                           | 83.6  | .095                                                            |
| 1N3046BUR-1                      | MLL3046B                    | 120                                                                         | 2.0                                         | 550                                    | 4500                              | .25 | 12                                             | 0.5                                                                           | 91.2  | .095                                                            |
| 1N3047BUR-1                      | MLL3047B                    | 130                                                                         | 1.9                                         | 700                                    | 5000                              | .25 | 10.35                                          | 0.5                                                                           | 98.8  | .095                                                            |
| 1N3048BUR-1                      | MLL3048B                    | 150                                                                         | 1.7                                         | 1000                                   | 6000                              | .25 | 8.55                                           | 0.5                                                                           | 114.0 | .095                                                            |
| 1N3049BUR-1                      | MLL3049B                    | 160                                                                         | 1.6                                         | 1100                                   | 6500                              | .25 | 8.1                                            | 0.5                                                                           | 121.6 | .095                                                            |
| 1N3050BUR-1                      | MLL3050B                    | 180                                                                         | 1.4                                         | 1200                                   | 7000                              | .25 | 7.35                                           | 0.5                                                                           | 136.8 | .095                                                            |
| 1N3051BUR-1                      | MLL3051B                    | 200                                                                         | 1.2                                         | 1500                                   | 8000                              | .25 | 6.9                                            | 0.5                                                                           | 152.0 | .100                                                            |

\* JEDEC registered data for 1N3016B thru 3051B equivalents except reverse (leakage) currents  $I_R$  are lower and maximum Zener current  $I_{ZM}$  is higher.

\*\* When applicable, add MQ, MX, MV, MSP prefix for 1N3016B to 1N3051B screening options in accordance with MIL-PRF-19500/115.

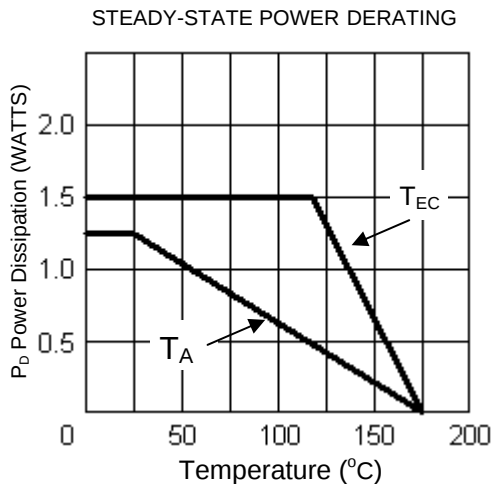
† Not JEDEC Data.

**NOTE 1:** Suffix "B" shown signifies a +/-5% tolerance on nominal zener voltage. No suffix designates a +/-20% and suffix "A" is +/-10%. If tighter tolerance is required, suffix C is used to identify +/-2%; and suffix D is to identify +/-1% tolerance.  $V_Z$  is measured with the diode in thermal equilibrium in 25°C still air. The test currents ( $I_{ZT}$ ) at nominal voltages provide a constant 0.25 watts for this device series.

**NOTE 2:** The zener impedance is derived when a 60 cycle ac current having an rms value equal to 10% of the dc zener current ( $I_{ZT}$  or  $I_{ZK}$ ) is superimposed on  $I_{ZT}$  or  $I_{ZK}$ . Zener impedance is measured at 2 points to ensure a sharp knee on the breakdown curve and to eliminate unstable units. See MicroNote 202 for variation in dynamic impedance with different zener currents.

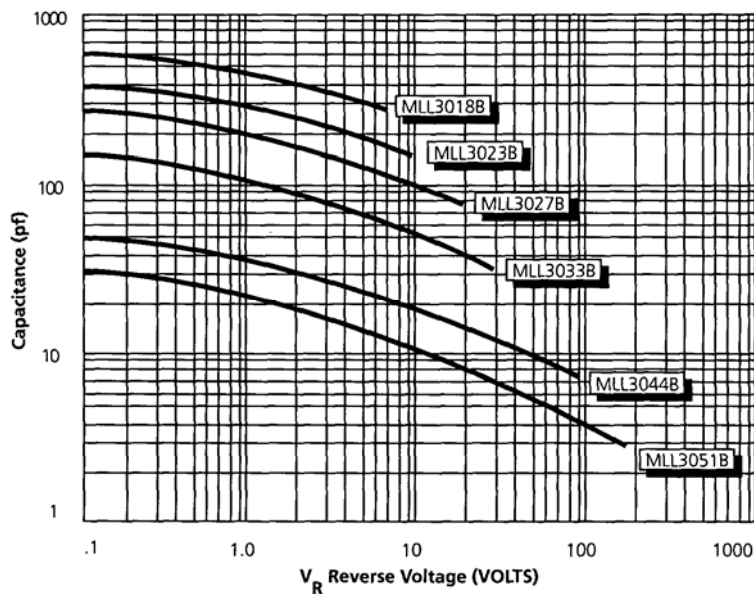
**NOTE 3:** This product series has previously been identified as MLL3016B thru MLL3051B by Microsemi. This alternate name may still be used, however the Industry name of 1N3016BUR-1 thru 1N3051BUR-1 is preferred.

## GRAPHS



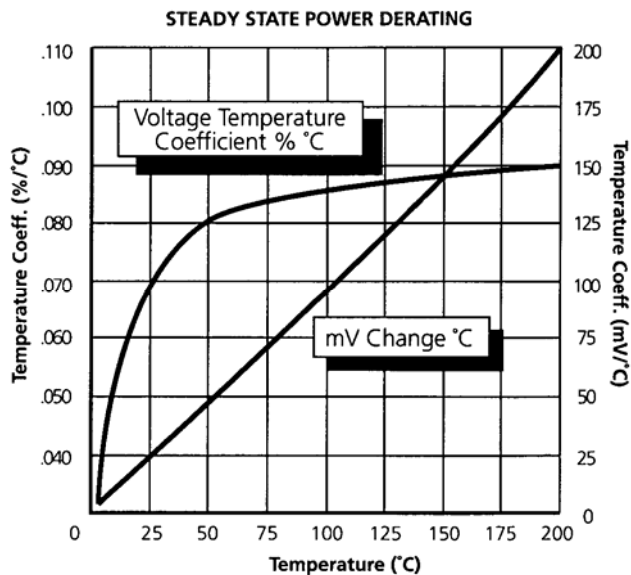
**FIGURE 1**

Power Derating Curve Where  $T_{EC}$  is End Cap Temp and  $T_A$  is Ambient Temperature on FR4 PC board.



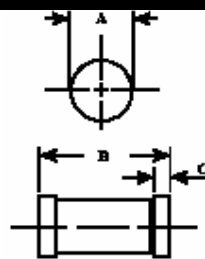
**FIGURE 2**

Typical Capacitance vs. Reverse Voltage

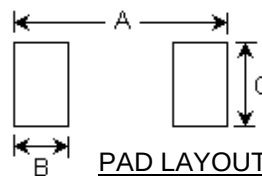


**FIGURE 3** Typical Zener Voltage  
Temperature Coeff. vs. Zener Voltage

## PACKAGE DIMENSIONS



| DIM | INCHES |       | MILLIMETERS |      |
|-----|--------|-------|-------------|------|
|     | MIN    | MAX   | MIN         | MAX  |
| A   | 0.094  | 0.105 | 2.39        | 2.66 |
| B   | 0.189  | 0.205 | 4.80        | 5.20 |
| C   | 0.016  | 0.022 | 0.41        | 0.55 |



|   | INCHES | mm   |
|---|--------|------|
| A | .276   | 7.00 |
| B | 0.070  | 1.8  |
| C | 0.110  | 2.8  |