



## 500 mW SURFACE MOUNT ZENER DIODES

Screening in  
reference to  
MIL-PRF-19500  
available

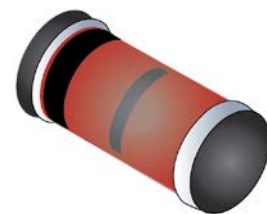
### DESCRIPTION

The 1N4678UR-1 thru 1N4717UR-1 series of 0.5 watt glass surface mount DO-213AA Zener voltage regulators provides a selection from 1.8 to 43 volts. Standard tolerance is +/-5%, with 1% and 2% options available. The Zener test current is only 50 uA. The metal slugs that sandwich the die are metallurgically bonded to the silicon for high reliability. This type of internally bonded Zener package construction is also available with high-reliability up-screening as described in the Features section. Microsemi also offers numerous other Zener products to meet higher and lower power applications.

**Important:** For the latest information, visit our website <http://www.microsemi.com>.

### FEATURES

- Surface mount equivalent of JEDEC registered 1N4678 thru 1N4717 series.
- Internal metallurgical bond.
- Hermetically sealed surface mount package.
- Tighter voltage tolerances of 2% and 1% are available.
- Up-screening available in reference to MIL-PRF-19500.  
(See [part nomenclature](#) for all available options.)
- RoHS compliant devices available (commercial grade only).



**DO-213AA Package**

### Also available in:

 **DO-35 (DO-204AH)**  
(surface mount)  
[1N4678-1 – 1N4717-1](#)

### APPLICATIONS / BENEFITS

- Regulates voltage over a broad operating current and temperature range.
- Voltage selection from 1.8 to 43 V.
- Non-sensitive to ESD per MIL-STD-750 method 1020.
- Minimal capacitance (see [Figure 2](#)).
- Inherently radiation hard as described in Microsemi's "[MicroNote 050](#)".

### MAXIMUM RATINGS

| Parameters/Test Conditions                            | Symbol              | Value       | Unit |
|-------------------------------------------------------|---------------------|-------------|------|
| Junction and Storage Temperature                      | $T_J$ and $T_{STG}$ | -65 to +175 | °C   |
| Thermal Resistance Junction-to-End Cap <sup>(1)</sup> | $R_{\theta JL}$     | 100         | °C/W |
| Thermal Resistance Junction-to-Ambient <sup>(1)</sup> | $R_{\theta JA}$     | 250         | °C/W |
| Steady-State Power Dissipation <sup>(2)</sup>         | $P_D$               | 0.5         | W    |
| Forward Voltage @ 100 mA                              | $V_F$               | 1.5         | V    |
| Solder Temperature @ 10 s                             | $T_{SP}$            | 260         | °C   |

**Notes:** 1. When mounted on FR4 PC board (1 oz Cu) with recommended footprint (see last page).  
2. At  $T_{EC} \leq 125$  °C or at ambient  $T_A \leq 50$  °C when mounted on FR4 PC board.

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**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed glass DO-213AA (SOD80 or MLL34) MELF style package.
- TERMINALS: End caps available with tin-lead plating or RoHS compliant matte-tin plating (commercial version only). Solderable per MIL-STD-750, method 2026.
- POLARITY: Cathode indicated by band where diode is to be operated with the banded end positive with respect to the opposite end for Zener regulation.
- MARKING: The cathode is the banded end of the device.
- TAPE & REEL option: Standard per EIA-481-1-B (add "TR" suffix to part number). Consult factory for quantities.
- WEIGHT: 0.04 grams.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**MQ 1N4678 C UR -1 (e3)**

**Reliability Level**

MQ (reference JAN)  
MX reference JANTX  
MV (reference JANTXV)  
MSP (reference JANS)  
Blank = Commercial

**JEDEC type number**

(see [Electrical Characteristics](#)  
table)

**RoHS Compliance**

e3 = RoHS Compliant ([available on commercial grade only](#))  
Blank = non-RoHS Compliant

**Metallurgically Bonded**
**Surface Mount package**
**Zener Voltage Tolerances**

Blank = 5%  
C = 2%  
D = 1%

**SYMBOLS & DEFINITIONS**

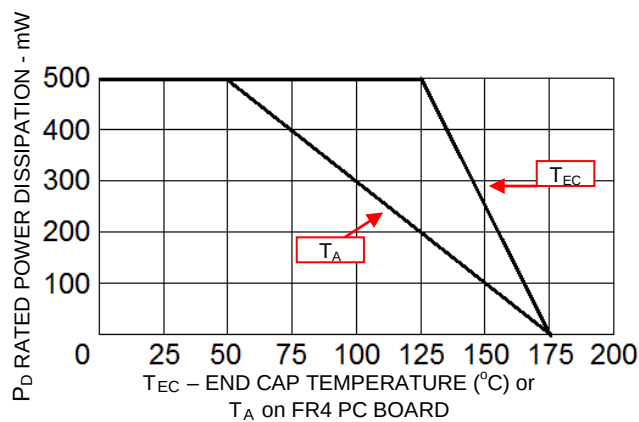
| Symbol               | Definition                                                                                                                       |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------|
| $I_{ZT}$ or $I_{ZK}$ | Regulator Current: The dc regulator current ( $I_Z$ ), at a specified test point ( $I_{ZT}$ ), near breakdown knee ( $I_{ZK}$ ). |
| $I_R$                | Reverse Current: The maximum reverse (leakage) current that will flow at the specified voltage and temperature.                  |
| $I_{ZM}$             | Maximum Regulator (Zener) Current: The maximum rated dc current for the specified power rating.                                  |
| $T_{SP}$             | Temperature Solder Pad: The maximum solder temperature that can be safely applied to the terminal.                               |
| $V_R$                | Reverse Voltage: The reverse voltage dc value, no alternating component.                                                         |
| $V_Z$                | Zener Voltage: The Zener voltage the device will exhibit at a specified current ( $I_Z$ ) in its breakdown region.               |

**ELECTRICAL CHARACTERISTICS @ 25 °C unless otherwise noted.**

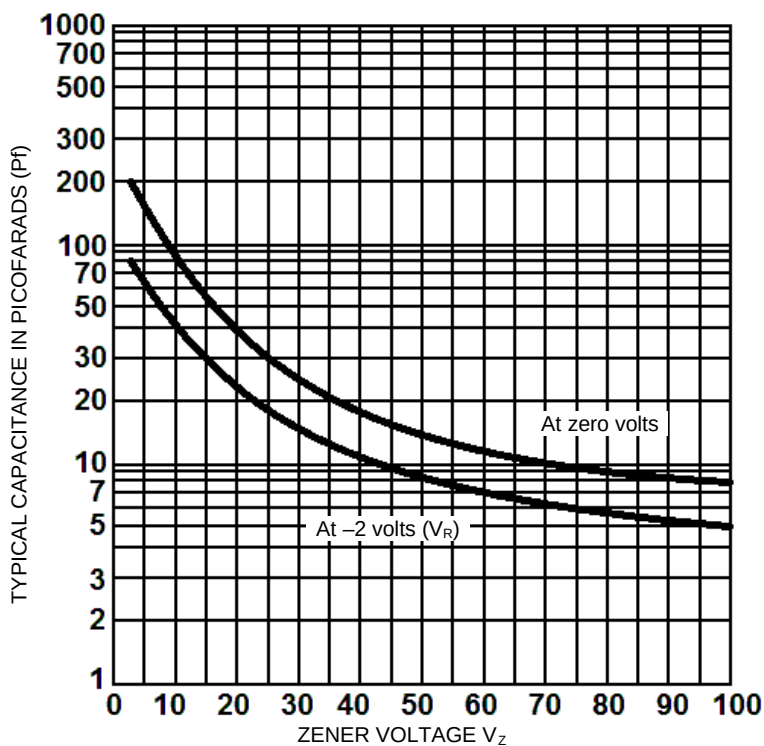
| JEDEC TYPE<br>NUMBER<br><br>(Note 1) | NOMINAL<br>ZENER<br>VOLTAGE<br>(Note 3) | ZENER TEST<br>CURRENT | MAXIMUM<br>VOLTAGE<br>REGULATION<br>(Note 2 & 3) | MAXIMUM REVERSE<br>LEAKAGE CURRENT |       | MAXIMUM dc<br>ZENER<br>CURRENT* |
|--------------------------------------|-----------------------------------------|-----------------------|--------------------------------------------------|------------------------------------|-------|---------------------------------|
|                                      | V <sub>Z</sub>                          | I <sub>ZT</sub>       | ΔV <sub>Z</sub>                                  | I <sub>R</sub> @ V <sub>R</sub>    |       | I <sub>ZM</sub>                 |
|                                      | Volts                                   | μA                    | Volts                                            | μA                                 | Volts | mA                              |
| 1N4678UR-1                           | 1.8                                     | 50                    | 0.70                                             | 7.5                                | 1.0   | 240                             |
| 1N4679UR-1                           | 2.0                                     | 50                    | 0.70                                             | 5.0                                | 1.0   | 220                             |
| 1N4680UR-1                           | 2.2                                     | 50                    | 0.75                                             | 4.0                                | 1.0   | 200                             |
| 1N4681UR-1                           | 2.4                                     | 50                    | 0.80                                             | 2.0                                | 1.0   | 190                             |
| 1N4682UR-1                           | 2.7                                     | 50                    | 0.85                                             | 1.0                                | 1.0   | 180                             |
| 1N4683UR-1                           | 3.0                                     | 50                    | 0.90                                             | 0.8                                | 1.0   | 170                             |
| 1N4684UR-1                           | 3.3                                     | 50                    | 0.95                                             | 7.5                                | 1.5   | 160                             |
| 1N4685UR-1                           | 3.6                                     | 50                    | 0.95                                             | 7.5                                | 2.0   | 150                             |
| 1N4686UR-1                           | 3.9                                     | 50                    | 0.97                                             | 5.0                                | 2.0   | 140                             |
| 1N4687UR-1                           | 4.3                                     | 50                    | 0.99                                             | 4.0                                | 2.0   | 130                             |
| 1N4688UR-1                           | 4.7                                     | 50                    | 0.99                                             | 10.0                               | 3.0   | 120                             |
| 1N4689UR-1                           | 5.1                                     | 50                    | 0.97                                             | 10.0                               | 3.0   | 110                             |
| 1N4690UR-1                           | 5.6                                     | 50                    | 0.96                                             | 10.0                               | 4.0   | 100                             |
| 1N4691UR-1                           | 6.2                                     | 50                    | 0.95                                             | 10.0                               | 5.0   | 90                              |
| 1N4692UR-1                           | 6.8                                     | 50                    | 0.90                                             | 10.0                               | 5.1   | 70                              |
| 1N4693UR-1                           | 7.5                                     | 50                    | 0.75                                             | 10.0                               | 5.7   | 63.6                            |
| 1N4694UR-1                           | 8.2                                     | 50                    | 0.50                                             | 1.0                                | 6.2   | 58.0                            |
| 1N4695UR-1                           | 8.7                                     | 50                    | 0.10                                             | 1.0                                | 6.6   | 54.8                            |
| 1N4696UR-1                           | 9.1                                     | 50                    | 0.08                                             | 1.0                                | 6.9   | 52.4                            |
| 1N4697UR-1                           | 10.0                                    | 50                    | 0.10                                             | 1.0                                | 7.6   | 49.6                            |
| 1N4698UR-1                           | 11.0                                    | 50                    | 0.11                                             | 0.05                               | 8.4   | 43.2                            |
| 1N4699UR-1                           | 12.0                                    | 50                    | 0.12                                             | 0.05                               | 9.1   | 40.8                            |
| 1N4700UR-1                           | 13.0                                    | 50                    | 0.13                                             | 0.05                               | 9.8   | 38.0                            |
| 1N4701UR-1                           | 14.0                                    | 50                    | 0.14                                             | 0.05                               | 10.6  | 35.0                            |
| 1N4702UR-1                           | 15.0                                    | 50                    | 0.15                                             | 0.05                               | 11.4  | 32.6                            |
| 1N4703UR-1                           | 16.0                                    | 50                    | 0.16                                             | 0.05                               | 12.1  | 30.8                            |
| 1N4704UR-1                           | 17.0                                    | 50                    | 0.17                                             | 0.05                               | 12.9  | 29.0                            |
| 1N4705UR-1                           | 18.0                                    | 50                    | 0.18                                             | 0.05                               | 13.6  | 26.4                            |
| 1N4706UR-1                           | 19.0                                    | 50                    | 0.19                                             | 0.05                               | 14.4  | 25.0                            |
| 1N4707UR-1                           | 20.0                                    | 50                    | 0.20                                             | 0.01                               | 15.2  | 23.8                            |
| 1N4708UR-1                           | 22.0                                    | 50                    | 0.22                                             | 0.01                               | 16.7  | 21.6                            |
| 1N4709UR-1                           | 24.0                                    | 50                    | 0.24                                             | 0.01                               | 18.2  | 19.8                            |
| 1N4710UR-1                           | 25.0                                    | 50                    | 0.25                                             | 0.01                               | 19.0  | 19.0                            |
| 1N4711UR-1                           | 27.0                                    | 50                    | 0.27                                             | 0.01                               | 20.4  | 17.6                            |
| 1N4712UR-1                           | 28.0                                    | 50                    | 0.28                                             | 0.01                               | 21.2  | 17.0                            |
| 1N4713UR-1                           | 30.0                                    | 50                    | 0.30                                             | 0.01                               | 22.8  | 15.8                            |
| 1N4714UR-1                           | 33.0                                    | 50                    | 0.33                                             | 0.01                               | 25.0  | 14.4                            |
| 1N4715UR-1                           | 36.0                                    | 50                    | 0.36                                             | 0.01                               | 27.3  | 13.2                            |
| 1N4716UR-1                           | 39.0                                    | 50                    | 0.39                                             | 0.01                               | 29.6  | 12.2                            |
| 1N4717UR-1                           | 43.0                                    | 50                    | 0.43                                             | 0.01                               | 32.6  | 11.0                            |

\*JEDEC registered data except that I<sub>ZM</sub> has been increased (doubled) for 500 mW power dissipation capabilities.

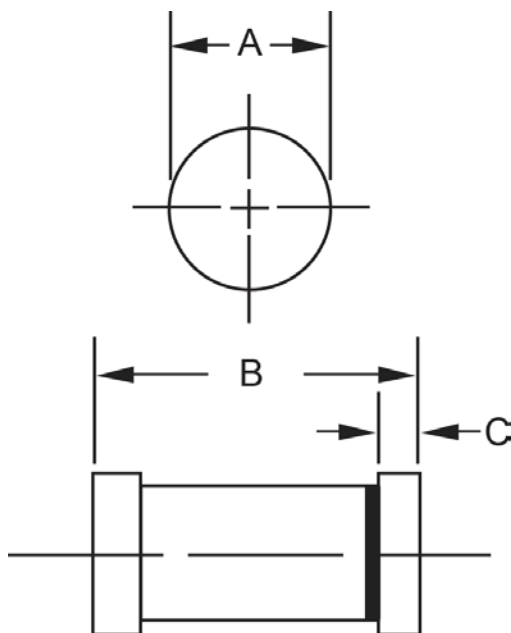
- NOTES:**
1. All types as shown are +/-5% tolerance. Also available in 2% and 1% tolerance.
  2. ΔV<sub>Z</sub> @ 100 μA minus V<sub>Z</sub> @ 10 μA.
  3. The electrical characteristics are measured after allowing the device to stabilize for 20 seconds when mounted with 3/8" minimum lead length from the base.

**GRAPHS**


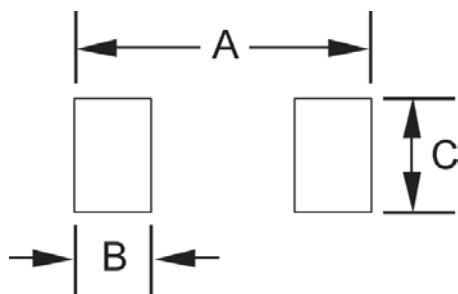
**FIGURE 1**  
**POWER DERATING CURVE**



**FIGURE 2**  
**CAPACITANCE vs. ZENER VOLTAGE (TYPICAL)**

**PACKAGE DIMENSIONS**


| DIM      | INCH  |       | MILLIMETERS |      |
|----------|-------|-------|-------------|------|
|          | MIN   | MAX   | MIN         | MAX  |
| <b>A</b> | 0.063 | 0.067 | 1.60        | 1.70 |
| <b>B</b> | 0.130 | 0.146 | 3.30        | 3.70 |
| <b>C</b> | 0.016 | 0.022 | 0.41        | 0.55 |

**PAD LAYOUT**


|          | inch | mm   |
|----------|------|------|
| <b>A</b> | .200 | 5.08 |
| <b>B</b> | .055 | 1.40 |
| <b>C</b> | .080 | 2.03 |