



**VOIDLESS HERMETICALLY SEALED  
500mW GLASS ZENER DIODES**  
Qualified per MIL-PRF-19500/533

Qualified Levels:  
JAN, JANTX, JANTXV  
and JANS

**DESCRIPTION**

This Zener voltage regulator series is military qualified and is ideal for high-reliability applications where a failure cannot be tolerated. These industry-recognized 0.5 watt Zener voltage regulators are hermetically sealed with voidless-glass construction using an internal metallurgical bond. It includes Zener selections from 2.4 to 200 volts in standard 5% tolerances as well as 1% and 2% tolerances. They are also available in surface-mount packages. Microsemi also offers numerous other Zener products to meet higher and lower power ratings in both thru-hole and surface mount packages.

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

**FEATURES**

- JEDEC registered 1N6309 thru 1N6355 series.
- Voltage tolerances of 1%, 2% and 5% are available. (See [part nomenclature](#).)
- Voidless hermetically sealed glass package.
- Internal "Category I" metallurgical bonds for 1N6321 thru 1N6355 and "Category III" for 1N6309 thru 1N6320.
- JAN, JANTX, JANTXV, and JANS reliability levels are available per MIL-PRF-19500/533.
- RoHS compliant versions available (commercial grade only).



**DO-35 or  
"D" Package**

Also available in:

**"B" SQ MELF package**  
(surface mount)  
 [1N6309US - 1N6355DUS](#)

**APPLICATIONS / BENEFITS**

- Small DO-35 size package (or "D" Package).
- Regulates voltage over a broad operating current and temperature range.
- Extensive selection from 2.4 to 200 volts.
- Standard and tight voltage tolerances available.
- Extremely robust construction.
- Flexible axial-lead mounting terminals.
- Non-sensitive to ESD per MIL-STD-750 method 1020.
- Inherently radiation hard as described in Microsemi "[MicroNote 050](#)".

**MAXIMUM RATINGS**

Parameters/Test Conditions	Symbol	Value	Unit
Junction and Storage Temperature	T <sub>J</sub> and T <sub>STG</sub>	-65 to +175	°C
Thermal Resistance Junction-to-Lead <sup>(1)</sup>	R <sub>θJL</sub>	150	°C/W
1N6309 – 1N6320		95.5	
1N6321 – 1N6355			
Thermal Resistance Junction-to-Ambient <sup>(2)</sup>	R <sub>θJA</sub>	240	°C/W
Steady-State Power Dissipation @ T <sub>L</sub> = 75 °C	P <sub>D</sub>	0.5	W
Forward Voltage @ 1.0 A	V <sub>F</sub>	1.4	V
Solder Temperature @ 10 s	T <sub>SP</sub>	260	°C

- Notes:**
1. At 3/8 inch (10 mm) from body. See [Figure 1](#) and [Figure 2](#) for derating.
  2. T<sub>A</sub> = +55 °C before derating on printed circuit board (PCB), PCB = FR4 .0625 inch (1.59 mm) 1-layer 1-Oz Cu, horizontal, still air, pads = .092 inch (2.34 mm) diameter, strip = .030 inch (0.76 mm) x 1 inch (25.4 mm) long, axial lead length L ≤ .187 inch (≤ 4.75 mm); R<sub>θJA</sub> with a defined thermal resistance condition included is measured at I<sub>Z</sub> = as defined in the characteristics and ratings table herein.

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**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed voidless hard glass with tungsten slugs.
- TERMINALS: Axial-leads are tin/lead (Sn/Pb) or RoHS compliant matte/tin (commercial grade only) over copper clad steel.
- MARKING: Body painted and part number.
- POLARITY: Cathode indicated by band.
- TAPE & REEL option: Standard per EIA-296. Consult factory for quantities.
- WEIGHT: 150 milligrams.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**JAN 1N6309 C (e3)**

**Reliability Level**

JAN = JAN Level  
 JANTX = JANTX Level  
 JANTXV = JANTXV Level  
 JANS = JANS Level  
 Blank = Commercial

**JEDEC type number**

(see [Electrical Characteristics](#) table)

**RoHS Compliance**

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

**Zener Voltage Tolerance**

C = +/- 2%  
 D = +/- 1%  
 Blank = +/- 5%

**SYMBOLS & DEFINITIONS**

Symbol	Definition
$I_R$	Reverse Current: The maximum reverse (leakage) current that will flow at the specified voltage and temperature.
$I_Z, I_{ZT}, I_{ZK}$	Regulator Current: The dc regulator current ( $I_Z$ ), at a specified test point ( $I_{ZT}$ ), near breakdown knee ( $I_{ZK}$ ).
$I_{ZM}$	Maximum Regulator (Zener) Current: The maximum rated dc current for the specified power rating.
$I_{ZSM}$	Maximum Zener Surge Current: The non-repetitive peak value of Zener surge current at a specified wave form.
$V_F$	Maximum Forward Voltage: The maximum forward voltage the device will exhibit at a specified current.
$V_{WM}$	Working Peak Voltage: The maximum peak voltage that can be applied over the operating temperature range. This is also referred to as Standoff Voltage.
$V_Z$	Zener Voltage: The Zener voltage the device will exhibit at a specified current ( $I_Z$ ) in its breakdown region.
$Z_{ZT}$ or $Z_{ZK}$	Dynamic Impedance: The small signal impedance of the diode when biased to operate in its breakdown region at a specified rms current modulation (typically 10% of $I_{ZT}$ or $I_{ZK}$ ) and superimposed on $I_{ZT}$ or $I_{ZK}$ respectively.

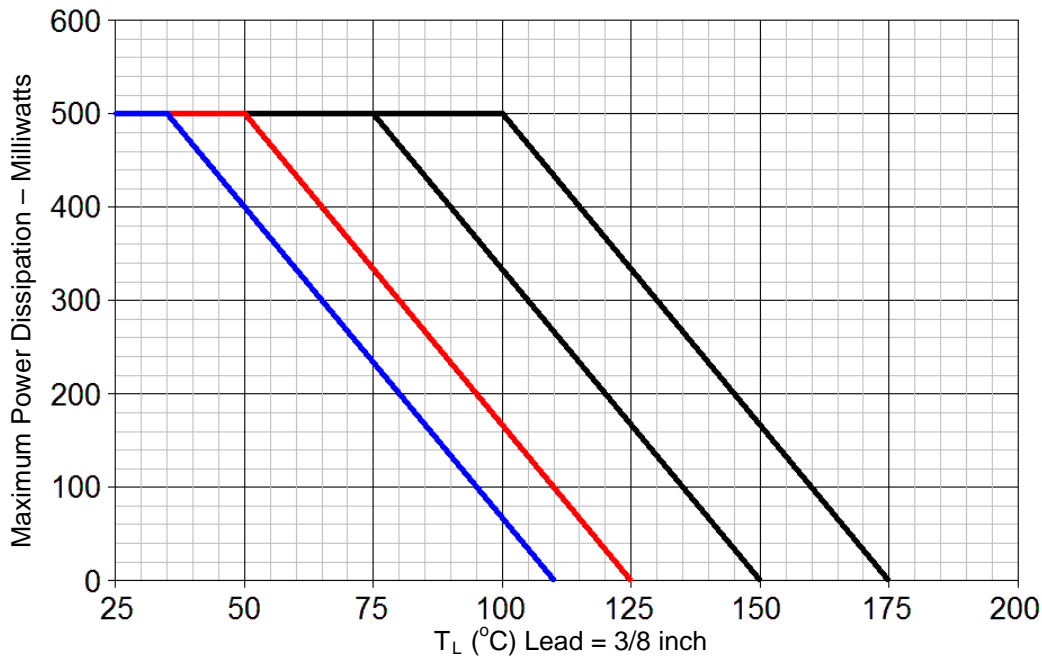
**ELECTRICAL CHARACTERISTICS @ 25°C**

TYPE Note 1	V <sub>Z2</sub> NOM. +/-5% @ I <sub>Z2</sub>	V <sub>Z1</sub> MIN. @ I <sub>Z1</sub> 250 µA	Test Current I <sub>Z2</sub>	Dynamic Impedance Z <sub>Z</sub> @ I <sub>Z2</sub>	Dynamic Impedance Z <sub>ZK</sub> @ 250 µA	Max. Current I <sub>ZM</sub>	Voltage Reg. V <sub>Z(reg)</sub> (ΔV <sub>Z</sub> ) Note 2	Surge Current 8.3 ms square Wave I <sub>ZSM</sub>	Reverse Voltage V <sub>R</sub>	Max. Reverse Current I <sub>R1</sub> @ V <sub>R</sub> 25 °C	Max. Reverse Current I <sub>R2</sub> @ V <sub>R</sub> 150 °C	Max. Noise Density N <sub>D</sub> @ 250 µA 1 to 3 kHz	Max. Temp. Coeff. of Zener Voltage α <sub>VZ</sub>
	Volts	Volts	mA	ohms	ohms	mA	Volts	Amps	Volts	µA	µA	µV /Hz	%/°C
1N6309	2.4	1.1	20	30	1,200	177	1.50	2.50	1.0	100	200	1	-.085
1N6310	2.7	1.2	20	30	1,300	157	1.50	2.20	1.0	60	150	1	-.080
1N6311	3.0	1.3	20	29	1,400	141	1.50	2.00	1.0	30	100	1	-.075
1N6312	3.3	1.5	20	27	1,400	128	1.60	1.80	1.0	5	20	1	-.070
1N6313	3.6	1.8	20	25	1,400	117	1.60	1.65	1.0	3	12	1	-.065
1N6314	3.9	2.0	20	23	1,700	108	1.60	1.50	1.0	2	12	1	-.060
1N6315	4.3	2.4	20	20	1,700	99	0.90	1.40	1.0	2	12	1	-.045 +.020
1N6316	4.7	2.8	20	17	1,500	90	0.50	1.27	1.5	5	12	1	-.028 +.032
1N6317	5.1	3.3	20	14	1,300	83	0.40	1.17	2.0	5	12	1	-.020 +.035
1N6318	5.6	4.3	20	8	1,200	76	0.40	1.10	2.5	5	10	2	+.050
1N6319	6.2	5.2	20	3	800	68	0.30	0.97	3.5	5	10	5	+.060
1N6320	6.8	6.0	20	3	400	63	0.35	1.23	4.0	2	50	5	+.062
1N6321	7.5	6.6	20	4	400	57	0.40	1.16	5.0	2	30	5	+.068
1N6322	8.2	7.5	20	5	400	52	0.40	1.07	6.0	1	10	20	+.075
1N6323	9.1	8.4	20	6	500	47	0.50	0.97	7.0	1	10	40	+.076
1N6324	10.0	9.1	20	6	500	43	0.50	0.89	8.0	1	10	80	+.079
1N6325	11.0	10.0	20	7	550	39	0.50	0.83	8.5	1	10	100	+.082
1N6326	12.0	11.0	20	7	550	35	0.55	0.77	9.0	1	10	100	+.083
1N6327	13.0	11.9	9.5	8	550	33	0.55	0.71	9.9	0.05	10	100	+.083
1N6328	15.0	13.8	8.5	10	600	28	0.70	0.62	11.0	0.05	10	100	+.084
1N6329	16.0	14.7	7.8	12	600	27	0.75	0.58	12.0	0.05	10	100	+.084
1N6330	18.0	16.6	7.0	14	600	24	0.85	0.52	14.0	0.05	10	100	+.085
1N6331	20.0	18.5	6.2	18	500	21	0.95	0.47	15.0	0.05	10	100	+.086
1N6332	22.0	20.4	5.6	20	500	19	1.05	0.43	17.0	0.05	10	100	+.087
1N6333	24.0	22.3	5.2	24	500	18	1.15	0.39	18.0	0.05	10	100	+.088
1N6334	27.0	25.2	4.6	27	500	16	1.30	0.35	21.0	0.05	10	100	+.090
1N6335	30.0	28.0	4.2	32	500	14	1.45	0.31	23.0	0.05	10	100	+.091
1N6336	33.0	30.9	3.8	40	600	13	1.60	0.28	25.0	0.05	10	100	+.092
1N6337	36.0	33.7	3.4	50	600	12	1.75	0.260	27.0	0.05	10	100	+.093
1N6338	39.0	36.6	3.2	55	700	11	1.90	0.240	30	0.05	10	100	+.094
1N6339	43.0	40.4	3.0	65	800	9.9	2.10	0.220	33	0.05	10	80	+.095
1N6340	47.0	44.2	2.7	75	900	9.0	2.25	0.200	36	0.05	10	80	+.095
1N6341	51.0	48.0	2.5	85	1,000	8.3	2.50	0.180	39	0.05	10	80	+.096
1N6342	56.0	52.7	2.2	100	1,200	7.6	2.70	0.170	43	0.05	10	80	+.097
1N6343	62.0	58.4	2.0	125	1,300	6.8	2.90	0.150	47	0.05	10	80	+.099
1N6344	68.0	64.1	1.8	155	1,500	6.3	3.20	0.130	52	0.05	10	80	+.101
1N6345	75.0	70.8	1.7	180	1,600	5.7	3.40	0.125	56	0.05	10	80	+.103
1N6346	82.0	77.4	1.5	220	1,800	5.2	3.80	0.115	62	0.05	10	80	+.105
1N6347	91.0	86.0	1.4	270	2,100	4.7	4.20	0.100	69	0.05	10	80	+.108
1N6348	100.0	94.5	1.3	340	2,400	4.3	4.40	0.095	76	0.05	10	80	+.110
1N6349	110.0	104.0	1.1	500	2,800	3.9	4.80	0.085	84	0.05	10	80	+.110
1N6350	120.0	113.0	1.0	600	3,200	3.5	5.20	0.080	91	0.05	10	80	+.110
1N6351	130.0	122	0.95	850	4,100	3.3	5.60	0.070	99	0.05	10	80	+.110
1N6352	150.0	141	0.85	1,000	4,500	2.8	7.00	0.065	114	0.05	10	80	+.110
1N6353	160.0	151	0.80	1,200	5,000	2.7	7.50	0.060	122	0.05	10	80	+.110
1N6354	180.0	170	0.68	1,500	5,600	2.4	9.00	0.050	137	0.05	10	80	+.110
1N6355	200.0	189	0.65	1,800	6,500	2.1	12.00	0.045	152	0.05	10	80	+.110

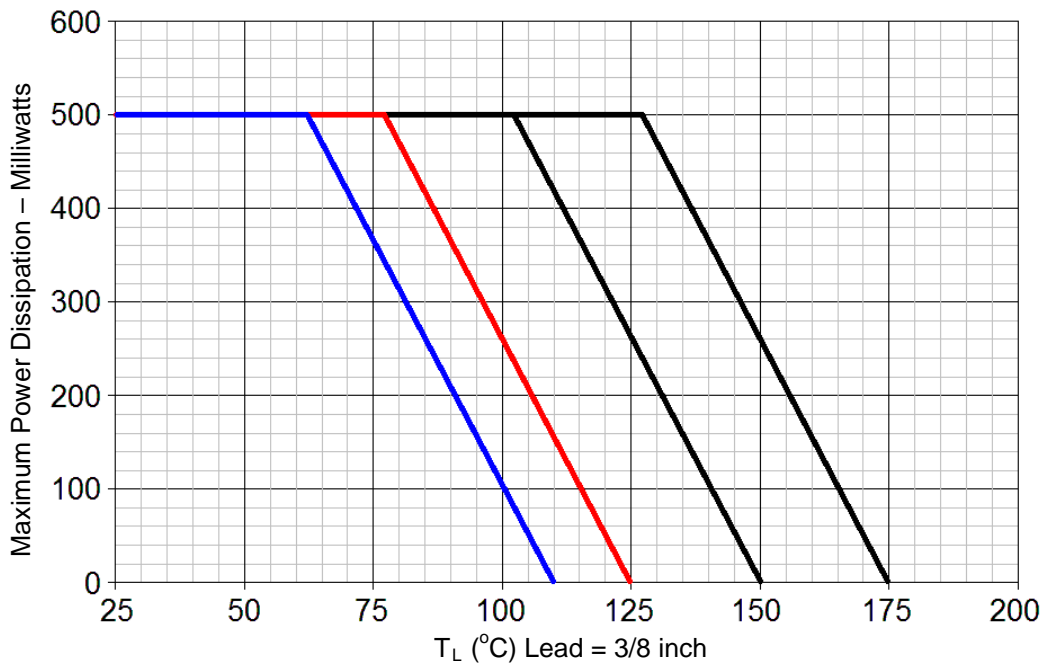
**NOTES:**

- Standard voltage tolerance is 5 percent. Tighter tolerances are available in plus/minus 1 and 2 percent voltage tolerances. (See [part nomenclature](#).)
- Voltage regulation V<sub>Z(reg)</sub> is the measured voltage change at thermal equilibrium between the current of 10% and 50% of maximum Zener current I<sub>ZM</sub> when the lead temperature is maintained at 25 °C =+8 °C, -2 °C.

GRAPHS

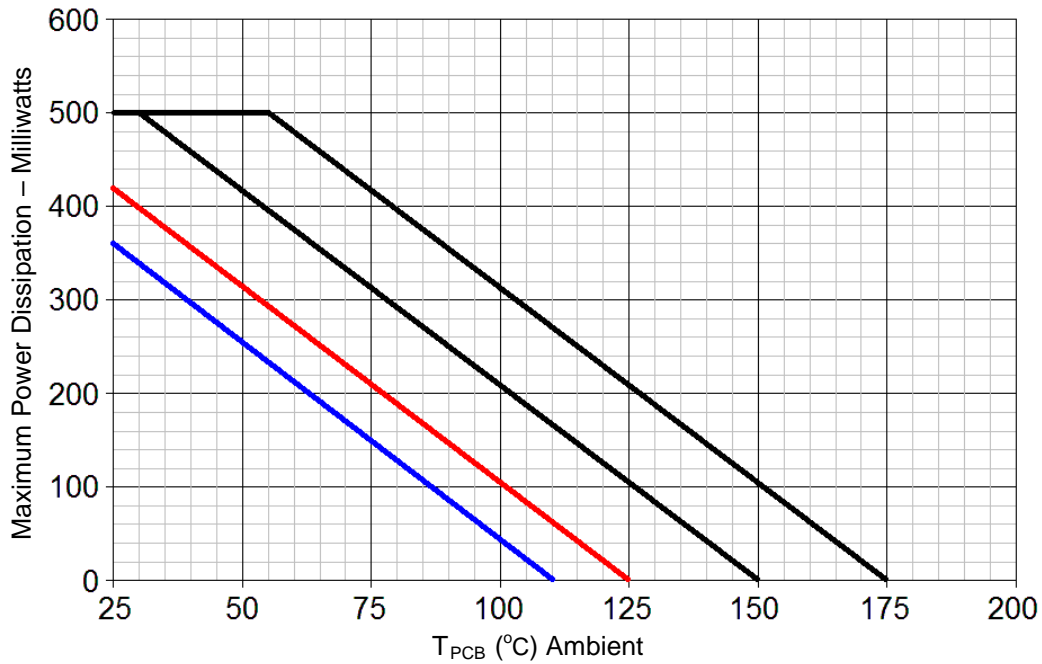


**FIGURE 1 - (1N6309 – 1N6320)**  
 $T_L$  Temperature-Power Derating Curve  
 $R_{\theta JL}$  3/8 inch = 150 °C/W (dc operation)

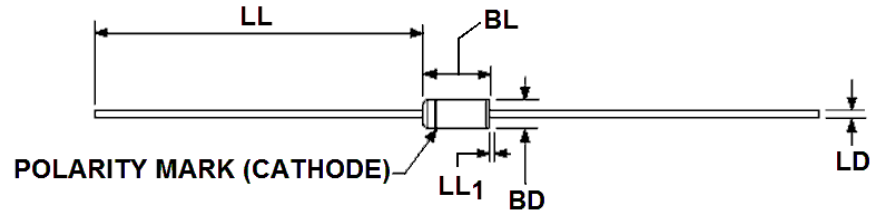


**FIGURE 2 - (1N6321 – 1N6355)**  
 $T_L$  Temperature-Power Derating Curve  
 $R_{\theta JL}$  3/8 inch = 95.5 °C/W (dc operation)

GRAPHS (continued)



**FIGURE 3**  
Temperature-Power Derating Curve  
 R<sub>θJA</sub> = 240 °C/W (dc operation)

**PACKAGE DIMENSIONS**

**NOTE:**

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Lead diameter not controlled in this zone to allow for flash.  
Lead finish build-up and minor irregularities other than slugs.
4. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi$ x symbology.
5. The BL dimension shall include the entire body including slugs.

Ltr	DIMENSIONS				Notes
	INCH		MILLIMETERS		
	Min	Max	Min	Max	
<b>BD</b>	.060	.090	1.52	2.29	
<b>BL</b>	.120	.200	3.05	5.08	5
<b>LD</b>	.018	.022	0.46	0.56	
<b>LL</b>	1.000	1.500	25.40	38.10	
<b>LL1</b>		.050		1.27	3