

## Temperature-Compensated Zener Reference Diodes

Temperature-compensated zener reference diodes utilizing a single chip oxide passivated junction for long-term voltage stability. A rugged, glass-enclosed, hermetically sealed structure.

### Mechanical Characteristics:

**CASE:** Hermetically sealed, all-glass

**DIMENSIONS:** See outline drawing.

**FINISH:** All external surfaces are corrosion resistant and leads are readily solderable.

**POLARITY:** Cathode indicated by polarity band.

**WEIGHT:** 0.2 Gram (approx.)

**MOUNTING POSITION:** Any

### Maximum Ratings

Junction Temperature: -55 to +175°C

Storage Temperature: -65 to +175°C

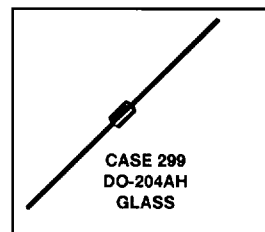
DC Power Dissipation: 400 mW @  $T_A = 50^\circ\text{C}$

**WAFER FAB LOCATION:** Phoenix, Arizona

**ASSEMBLY/TEST LOCATION:** Phoenix, Arizona

1N821,A 1N823,A  
1N825,A 1N827,A  
1N829,A

**TEMPERATURE-  
COMPENSATED  
SILICON ZENER  
REFERENCE DIODES  
6.2 V, 400 mW**



### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted. $V_Z = 6.2\text{ V} \pm 5\%$ @ $I_{ZT} = 7.5\text{ mA}$ ) (Note 5)

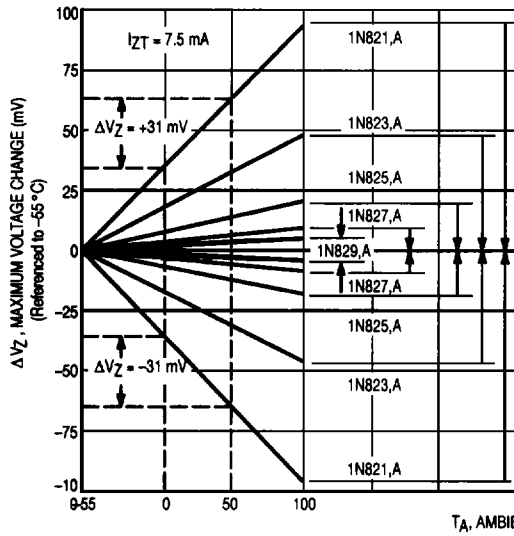
JEDEC Type No.	Maximum Voltage Change $\Delta V_Z$ (Volts) (Note 1)	Ambient Test Temperature $^\circ\text{C}$ $\pm 1^\circ\text{C}$	Temperature Coefficient For Reference Only $\%/^\circ\text{C}$ (Note 1)	Maximum Dynamic Impedance $Z_{ZT}$ Ohms (Note 2)
<b>1N821</b>	<b>0.096</b>	-55, 0, +25, +75, +100	<b>0.01</b>	15
<b>1N823</b>	<b>0.048</b>		0.005	
<b>1N825</b>	<b>0.019</b>		0.002	
1N827	0.009		0.001	
1N829	0.005		0.0005	
<b>1N821A</b>	<b>0.096</b>		<b>0.01</b>	10
<b>1N823A</b>	<b>0.048</b>		0.005	
<b>1N825A</b>	<b>0.019</b>		0.002	
1N827A	0.009		0.001	
1N829A	0.005		0.0005	

\*Tighter-tolerance units available on special request.

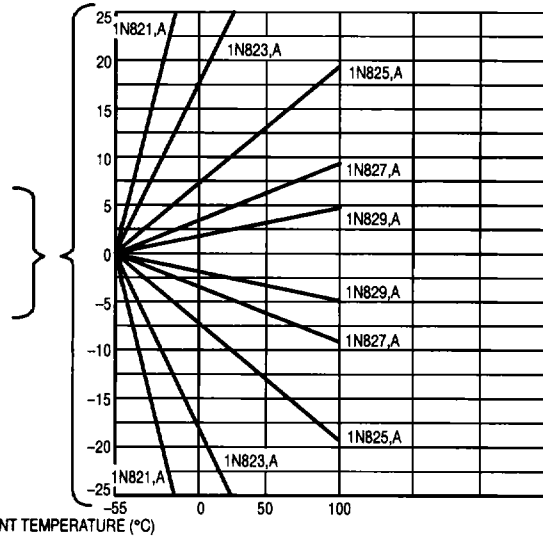
Devices listed in bold, italic are Motorola preferred devices.

**1N821,A 1N823,A 1N825,A 1N827,A 1N829,A**

**MAXIMUM VOLTAGE CHANGE versus AMBIENT TEMPERATURE**  
 (with  $I_{ZT} = 7.5 \text{ mA} \pm 0.01 \text{ mA}$ ) (See Note 3)  
 1N821 through 1N829

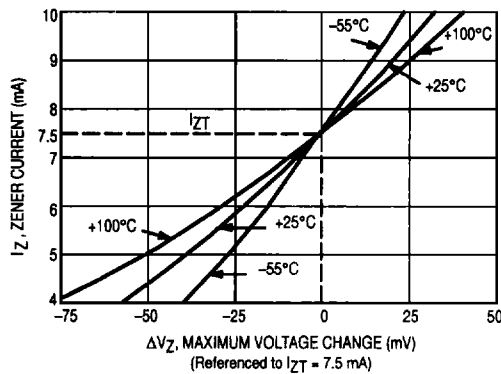


**Figure 1a**

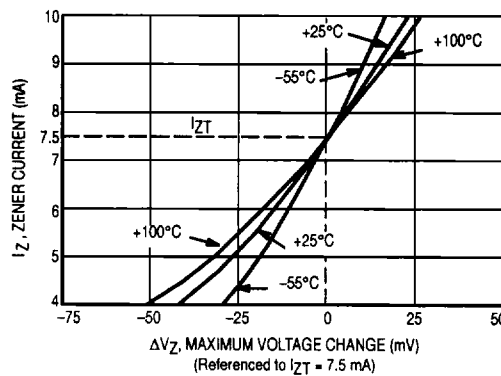


**Figure 1b**

**ZENER CURRENT versus MAXIMUM VOLTAGE CHANGE**  
 (At Specified Temperatures)  
 (See Note 4)  
 MORE THAN 95% OF THE UNITS ARE IN THE RANGES INDICATED BY THE CURVES.



**Figure 2. 1N821 Series**



**Figure 3. 1N821A Series**

# 1N821,A 1N823,A 1N825,A 1N827,A 1N829,A

## MAXIMUM ZENER IMPEDANCE versus ZENER CURRENT

(See Note 2)

MORE THAN 95% OF THE UNITS ARE IN THE RANGES INDICATED BY THE CURVES.

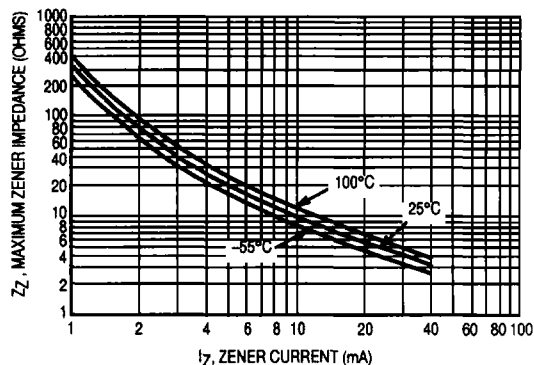


Figure 4. 1N821 Series

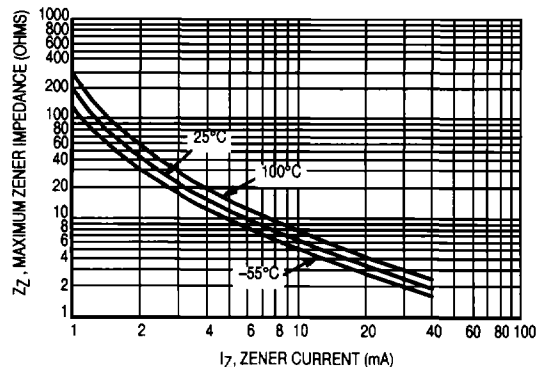


Figure 5. 1N821A Series

### NOTE 1. VOLTAGE VARIATION ( $\Delta V_Z$ ) AND TEMPERATURE COEFFICIENT

All reference diodes are characterized by the "box method." This guarantees a maximum voltage variation ( $\Delta V_Z$ ) over the specified temperature range, at the specified test current ( $I_{ZT}$ ), verified by tests at indicated temperature points within the range.  $V_Z$  is measured and recorded at each temperature specified. The  $\Delta V_Z$  between the highest and lowest values must not exceed the maximum  $\Delta V_Z$  given. This method of indicating voltage stability is now used for JEDEC registration as well as for military qualification. The former method of indicating voltage stability — by means of temperature coefficient accurately reflects the voltage deviation at the temperature extremes, but is not necessarily accurate within the temperature range because reference diodes have a nonlinear temperature relationship. The temperature coefficient, therefore, is given only as a reference.

### NOTE 2.

The dynamic zener impedance,  $Z_{ZT}$ , is derived from the 60 Hz ac voltage drop which results when an ac current with an rms value equal to 10% of the dc zener current,  $I_{ZT}$ , is superimposed on  $I_{ZT}$ . Curves showing the variation of zener impedance with zener current for each series are given in Figures 4 and 5.

### NOTE 3.

These graphs can be used to determine the maximum voltage change of any device in the series over any specific temperature range. For example, a temperature change from 0 to +50°C will cause a voltage change no greater than +31 mV or -31 mV for 1N821 or 1N821A, as illustrated by the dashed lines in Figure 1. The boundaries given are maximum values. For greater resolution, an expanded view of the center area in Figure 1a is shown in Figure 1b.

### NOTE 4.

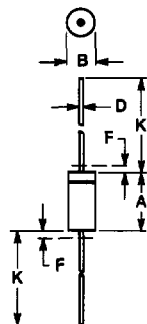
The maximum voltage change,  $\Delta V_Z$ , Figures 2 and 3 is due entirely to the impedance of the device. If both temperature and  $I_{ZT}$  are varied, then the total voltage change may be obtained by graphically adding  $\Delta V_Z$  in Figure 2 or 3 to the  $\Delta V_Z$  in Figure 1 for the device under consideration. If the device is to be operated at some stable current other than the specified test current, a new set of characteristics may be plotted by superimposing the data in Figure 2 or 3 on Figure 1. For a more detailed explanation see application note in later section.

### NOTE 5.

Zener voltage limits at 25°C measured with the test current ( $I_{ZT}$ ) applied with the device junction in thermal equilibrium at an ambient temperature of 25°C.

# Zener Voltage Reference Diodes

## 6.2 Volt OTC 400 mW DO-35



### NOTES:

1. PACKAGE CONTOUR OPTIONAL WITHIN A AND B HEAT SLUGS, IF ANY, SHALL BE INCLUDED WITHIN THIS CYLINDER, BUT NOT SUBJECT TO THE MINIMUM LIMIT OF B.
2. LEAD DIAMETER NOT CONTROLLED IN ZONE F TO ALLOW FOR FLASH, LEAD FINISH BUILDUP AND MINOR IRREGULARITIES OTHER THAN HEAT SLUGS.
3. POLARITY DENOTED BY CATHODE BAND.
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	3.05	5.08	0.120	0.200
B	1.52	2.29	0.060	0.090
D	0.46	0.66	0.018	0.022
F	—	1.27	—	0.050
K	25.40	38.10	1.000	1.500

All JEDEC dimensions and notes apply.

CASE 299-02  
DO-204AH  
GLASS

(Refer to Section 10 for Surface Mount, Thermal Data and Footprint Information.)

### MULTIPLE PACKAGE QUANTITY (MPQ) REQUIREMENTS

Package Option	Type No. Suffix	MPQ (Units)
Tape and Reel	RL, RL2 <sup>(1)</sup>	5K
Tape and Ammo	TA, TA2 <sup>(1)</sup>	5K

NOTE: 1. The "2" suffix designates 26 mm tape spacing.

(Refer to Section 10 for more information on Packaging Specifications.)