MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

1N935,A,B thru 1N939,A,B

Designer's Data Sheet

TEMPERATURE-COMPENSATED ZENER REFERENCE DIODES

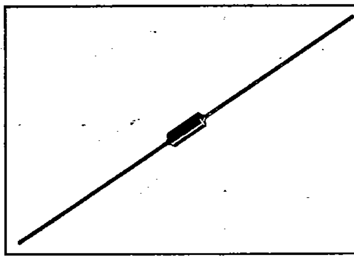
Temperature-compensated zener reference diodes utilizing an oxide-passivated junction for long-term voltage stability. A rugged, glass-enclosed, hermetically sealed structure.

Designer's Data for "Worst Case" Conditions

The Designers Data Sheet permits the design of most circuits entirely from the information presented. Limit data — representing device characteristic boundaries — are given to facilitate "worst case" design.

TEMPERATURE-COMPENSATED SILICON ZENER REFERENCE DIODES

9.0 V, 500 mW

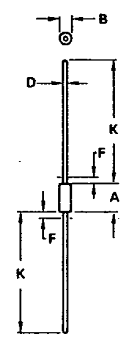


MAXIMUM RATINGS

Junction Temperature: -65 to +175°C
Storage Temperature. -65 to +175°C
DC Power Dissipation: 500 mW @ T_A = 25°C

MECHANICAL CHARACTERISTICS

CASE: Hermetically sealed, all-glass
DIMENSIONS: See outline drawing.
FINISH: All external surfaces are corrosion resistant and leads are readily solderable and weldable.
POLARITY: Cathode indicated by polarity band.
WEIGHT: 0.2 Gram (approx)
MOUNTING POSITION: Any



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	5.84	7.62	0.230	0.300
B	2.16	2.72	0.085	0.107
D	0.46	0.56	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 51-02
DO-204AA
GLASS**

NOTES:
1. PACKAGE CONTOUR OPTIONAL WITHIN DIA B AND LENGTH A. HEAT SLUGS, IF ANY, SHALL BE INCLUDED WITHIN THIS CYLINDER, BUT SHALL NOT BE SUBJECT TO THE MIN LIMIT OF DIA B.
2. LEAD DIA NOT CONTROLLED IN ZONES F, TO ALLOW FOR FLASH, LEAD FINISH BUILDUP, AND MINOR IRREGULARITIES OTHER THAN HEAT SLUGS.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted V_Z = 9.0 V ±5.0%* @ I_{ZT} = 7.5 mA)

JEDEC Type No. (Note 1)	Maximum Voltage Change ΔV_Z (Volts) (Note 2)	Ambient Test Temperature °C ±1°C	Temperature Coefficient %/°C (Note 2)	Maximum Dynamic Impedance Z_{ZT} (Ohms) (Note 3)
1N935	0.067	0, +25, +75	0.01	20
1N936	0.033		0.005	
1N937	0.013		0.002	
1N938	0.006		0.001	
1N939	0.003		0.0005	
1N935A	0.139	-55, 0, +25, +75, +100	0.01	20
1N936A	0.069		0.005	
1N937A	0.027		0.002	
1N938A	0.013		0.001	
1N939A	0.007		0.0005	
1N935B	0.184	-55, 0, +25, +75, +100, +150	0.01	20
1N936B	0.092		0.005	
1N937B	0.037		0.002	
1N938B	0.018		0.001	
1N939B	0.009		0.0005	

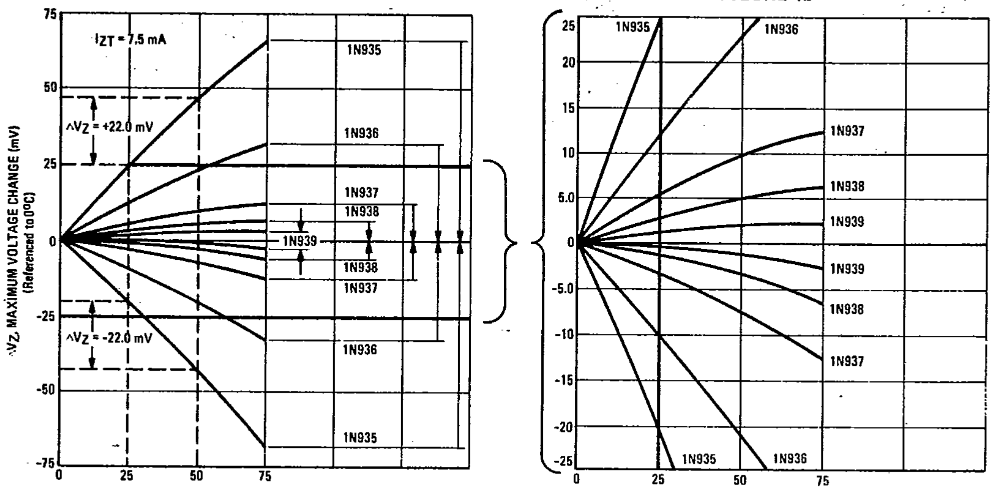
*Tighter-tolerance units available on special request.

MAXIMUM VOLTAGE CHANGE versus TEMPERATURE

(with I_{ZT} = 7.5 mA ±0.01 mA) (See Note 4)

1N935 thru 1N939

FIGURE 1a FIGURE 1b



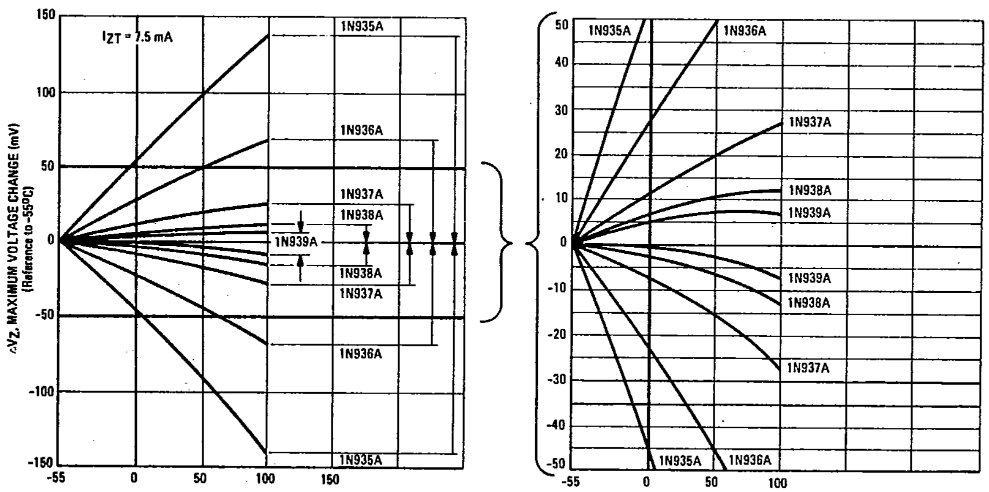
T_A, AMBIENT TEMPERATURE (°C)

MAXIMUM VOLTAGE CHANGE versus TEMPERATURE

(with I_{ZT} = 7.5 mA ±0.01 mA) (See Note 4)

1N935A thru 1N939A

FIGURE 2a FIGURE 2b



T_A, AMBIENT TEMPERATURE (°C)

MAXIMUM VOLTAGE CHANGE versus TEMPERATURE

(with I_{ZT} = 7.5 mA ±0.01 mA) (See Note 4)

1N935B thru 1N939B

FIGURE 3a

FIGURE 3b

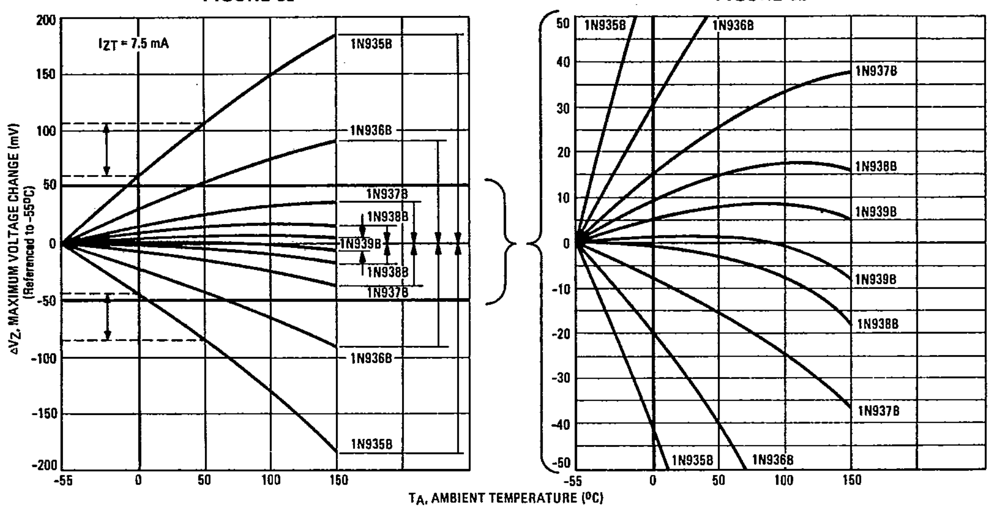


FIGURE 4 – ZENER CURRENT versus MAXIMUM VOLTAGE CHANGE (at specified temperatures)
(See Note 5)

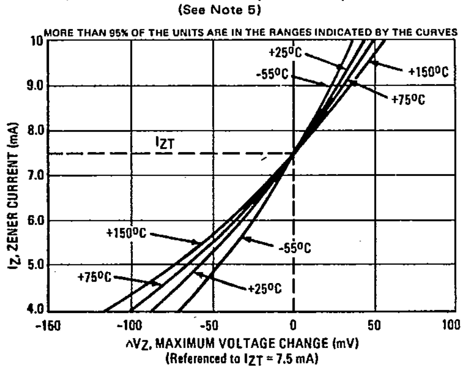
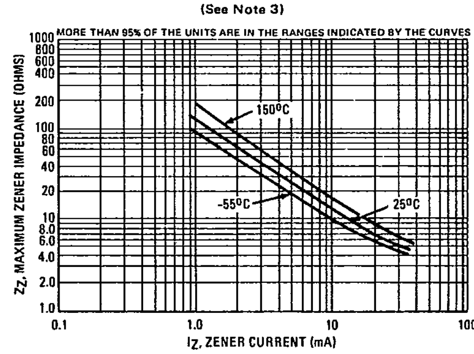


FIGURE 5 – MAXIMUM ZENER IMPEDANCE versus ZENER CURRENT
(See Note 3)



NOTE 1:

Types 1N935B, 1N937B, and 1N939B are available to MIL-S-19500/156 and MEG-A-LIFE II, Levels 1, 2, & 3, specifications.

NOTE 2:

Voltage Variation (ΔV_Z) and Temperature Coefficient.

All reference diodes are characterized by the "box method". This guarantees a maximum voltage variation (ΔV_Z) over the specified temperature range, at the specified test current (I_{ZT}), verified by tests at indicated temperature points within the range. 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 3:

Zener Impedance Derivation

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 Figure 5. A cathode-ray tube curve-trace test on a sample basis is used to ensure that each zener characteristic has a sharp and stable knee region.

NOTE 4:

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 +25 to +50°C will cause a voltage change no greater than +22 mV or -22 mV for 1N935, as illustrated by the dashed lines in Figure 1. The boundaries given are maximum values. For greater resolution, expanded views of the shaded areas in Figures 1a, 2a, and 3a are shown in Figures 1b, 2b, and 3b respectively.

NOTE 5:

The maximum voltage change, ΔV_Z, in Figure 4 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 adding ΔV_Z in Figure 4 to the ΔV_Z in Figure 1, 2, or 3 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 4 on Figure 1, 2, or 3.