Temperature-Compensated Zener Reference Diodes


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 @ $T_A = 50°C$

WAFER FAB LOCATION: Phoenix, Arizona
ASSEMBLY/TEST LOCATION: Phoenix, Arizona

Temperature-Compensated Silicon Zener Reference Diodes
6.2 V, 400 mW

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

*Tighter-tolerance units available on special request.
MAXIMUM VOLTAGE CHANGE versus AMBIENT TEMPERATURE
(with $I_{ZT} = 7.5 \text{ mA} \pm 0.01 \text{ mA}$) (See Note 3)
1N821 through 1N829

$\Delta V_Z = +31 \text{ mV}$
$\Delta V_Z = -31 \text{ mV}$

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
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 (ΔVZ) AND TEMPERATURE COEFFICIENT

All reference diodes are characterized by the "box method." This guarantees a maximum voltage variation (ΔVZ) over the specified temperature range, at the specified test current (IZT), verified by tests at indicated temperature points within the range. VZ is measured and recorded at each temperature specified. The ΔVZ between the highest and lowest values must not exceed the maximum ΔVZ 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, ΔVZ, 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 ΔVZ in Figure 2 or 3 to the ΔVZ 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

![Diode Image]

**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.

![Dimensions Table]

**Multiple Package Quantity (MPQ) Requirements**

<table>
<thead>
<tr>
<th>Package Option</th>
<th>Type No. Suffix</th>
<th>MPQ (Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tape and Reel</td>
<td>RL, RL2(1)</td>
<td>5K</td>
</tr>
<tr>
<td>Tape and Ammo</td>
<td>TA, TA2(1)</td>
<td>5K</td>
</tr>
</tbody>
</table>

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

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