



**MOTOROLA**

**1N4370 thru 1N4372  
See Page 6-4**

**1N4549 thru 1N4564  
See Page 6-23**

**LOW-LEVEL TEMPERATURE-COMPENSATED  
ZENER REFERENCE DIODES**

Highly reliable reference sources utilizing a nitride/oxide-passivated junction for long-term voltage stability. Glass construction provides a rugged, hermetically sealed structure.

- Low Power Drain Devices Specified @ 0.5 mA, 1.0 mA, 2.0 mA, and 4.0 mA
- Maximum Voltage Change Specified over Test Temperature Range
- Temperature Compensation Guaranteed over Two Standard Operating Temperature Ranges  
0 to 75°C  
-55 to 100°C

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
DC Power Dissipation @ $T_A = 50^\circ\text{C}$ Derate above 50°C	$P_D$	400 3.2	mW mW/°C
Junction and Storage Temperature Range	$T_J, T_{stg}$	-65 to +175	°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

**1N4565 thru 1N4584  
1N4765 thru 1N4784  
REFERENCE DIODES  
LOW LEVEL  
TEMPERATURE-COMPENSATED  
ZENER**

**1N4765 thru 1N4784**

NOTES:  
 1. PACKAGE CONTOUR OPTIONAL WITH CASE AND LEAD LENGTHS. JEDEC CASE SHALL BE INCLUDED WITHIN THIS CYLINDER BUT SHALL NOT BE SUBJECT TO THE MIN LIMIT FOR THIS.  
 2. LEAD DIAMETER CONTROLLED IN ZONE F TO ALLOW FOR FLASH LEAD FINISH BUILDUP AND WINDUP (AREA) - AREA IS OTHER THAN HEAT SLOTT.

MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.
A	1.64	1.76	0.230
B	2.19	2.22	0.085
D	0.46	0.56	0.018
F	1.27	-	0.050
K	25.40	28.10	1.000

**CASE 51-02  
DO-204AA  
(DO-7)**

ALL JEDEC dimensions are typical.

**1N4565 thru 1N4584**

NOTES:  
 1. PACKAGE CONTOUR OPTIONAL WITHIN A SMOOLED HEAT SLOTT. IF ANY SHALL BE INCLUDED WITHIN THIS CYLINDER BUT NOT SUBJECT TO THE MINIMUM LIMIT FOR B.  
 2. LEAD DIAMETER NOT CONTROLLED IN ZONE F TO ALLOW FOR FLASH LEAD FINISH BUILDUP AND WINDUP (AREA) - AREA IS OTHER THAN HEAT SLOTT. POLARITY INDICATED BY CATHODE BAND DIMENSIONING AND TOLERANCING PER ANSI Y14.5 (B).

MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.
A	1.05	1.08	0.120
B	1.52	1.53	0.060
D	0.46	0.56	0.018
F	1.27	-	0.050
K	25.40	28.10	1.000

**CASE 299-02  
DO-204AA  
(DO-35)**

ALL JEDEC dimensions and notes apply.

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# 1N4565 thru 1N4584, 1N4775 thru 1N4784, 1N4765 thru 1N4774

TYPE	$\Delta V_Z$ @ Test (Note 1) Temperature		Temperature Coefficient for Reference %/°C (Note 1)	Dynamic Imped. Ohms Max (Note 2)
	Volts Max	°C		
<b><math>V_Z = 6.4</math> Volts <math>\pm 5\%</math> (<math>I_{ZT} = 0.5</math> mA)</b>				
1N4565	0.048	0, +25, +75	0.01	200
1N4566	0.024		0.005	
1N4567	0.010		0.002	
1N4568	0.005		0.001	
1N4569	0.002		0.0005	
1N4565A	0.099	-55, 0, +25, +75, +100	0.01	200
1N4566A	0.050		0.005	
1N4567A	0.020		0.002	
1N4568A	0.010		0.001	
1N4569A	0.005		0.0005	
<b><math>V_Z = 6.4</math> Volts <math>\pm 5\%</math> (<math>I_{ZT} = 1.0</math> mA)</b>				
1N4570	0.048	0, +25, +75	0.01	100
1N4571	0.024		0.005	
1N4572	0.010		0.002	
1N4573	0.005		0.001	
1N4574	0.002		0.0005	
1N4570A	0.099	-55, 0, +25, +75, +100	0.01	100
1N4571A	0.050		0.005	
1N4572A	0.020		0.002	
1N4573A	0.010		0.001	
1N4574A	0.005		0.0005	
<b><math>V_Z = 6.4</math> Volts <math>\pm 5\%</math> (<math>I_{ZT} = 2.0</math> mA)</b>				
1N4575	0.048	0, +25, +75	0.01	50
1N4576	0.024		0.005	
1N4577	0.010		0.002	
1N4578	0.005		0.001	
1N4579	0.002		0.0005	
1N4575A	0.099	-55, 0, +25, +75, +100	0.01	50
1N4576A	0.050		0.005	
1N4577A	0.020		0.002	
1N4578A	0.010		0.001	
1N4579A	0.005		0.0005	
<b><math>V_Z = 6.4</math> Volts <math>\pm 5\%</math> (<math>I_{ZT} = 4.0</math> mA)</b>				
1N4580	0.048	0, +25, +75	0.01	25
1N4581	0.024		0.005	
1N4582	0.010		0.002	
1N4583	0.005		0.001	
1N4584	0.002		0.0005	
1N4580A	0.099	-55, 0, +25, +75, +100	0.01	25
1N4581A	0.050		0.005	
1N4582A	0.020		0.002	
1N4583A	0.010		0.001	
1N4584A	0.005		0.0005	

TYPE	$\Delta V_Z$ @ Test (Note 1) Temperature		Temperature Coefficient for Reference %/°C (Note 1)	Dynamic Imped. Ohms Max (Note 2)
	Volts Max	°C		
<b><math>V_Z = 8.5</math> Volts <math>\pm 5\%</math> (<math>I_{ZT} = 0.5</math> mA)</b>				
1N4775	0.064	0, +25, +75	0.01	200
1N4776	0.032		0.005	
1N4777	0.013		0.002	
1N4778	0.006		0.001	
1N4779	0.003		0.0005	
1N4775A	0.132	-55, 0, +25, +75, +100	0.01	200
1N4776A	0.066		0.005	
1N4777A	0.026		0.002	
1N4778A	0.013		0.001	
1N4779A	0.007		0.0005	
<b><math>V_Z = 8.5</math> Volts <math>\pm 5\%</math> (<math>I_{ZT} = 1.0</math> mA)</b>				
1N4780	0.064	0, +25, +75	0.01	100
1N4781	0.032		0.005	
1N4782	0.013		0.002	
1N4783	0.006		0.001	
1N4784	0.003		0.0005	
1N4780A	0.132	-55, 0, +25, +75, +100	0.01	100
1N4781A	0.066		0.005	
1N4782A	0.026		0.002	
1N4783A	0.013		0.001	
1N4784A	0.007		0.0005	
<b><math>V_Z = 9.1</math> Volts <math>\pm 5\%</math> (<math>I_{ZT} = 0.5</math> mA)</b>				
1N4785	0.068	0, +25, +75	0.01	350
1N4786	0.034		0.005	
1N4787	0.014		0.002	
1N4788	0.007		0.001	
1N4789	0.003		0.0005	
1N4785A	0.141	-55, 0, +25, +75, +100	0.01	350
1N4786A	0.070		0.005	
1N4787A	0.028		0.002	
1N4788A	0.014		0.001	
1N4789A	0.007		0.0005	
<b><math>V_Z = 9.1</math> Volts <math>\pm 5\%</math> (<math>I_{ZT} = 1.0</math> mA)</b>				
1N4770	0.068	0, +25, +75	0.01	200
1N4771	0.034		0.005	
1N4772	0.014		0.002	
1N4773	0.007		0.001	
1N4774	0.003		0.0005	
1N4770A	0.141	-55, 0, +25, +75, +100	0.01	200
1N4771A	0.070		0.005	
1N4772A	0.028		0.002	
1N4773A	0.014		0.001	
1N4774A	0.007		0.0005	

**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. 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  $I_{ZT}$ . A cathode-ray tube curve-trace test on a sample basis is used to ensure that the zener has a sharp and stable knee region.

