MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

1N4099 thru 1N4135
1N4614 thru 1N4627

LOW-LEVEL SILICON PASSIVATED ZENER DIODES

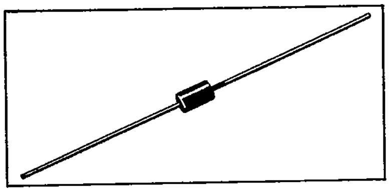
. . . designed for 250 mW applications requiring low leakage, low impedance, and low noise.

- Voltage Range from 1.8 to 100 Volts
- First Zener Diode Series to Specify Noise — 50% Lower than Conventional Diffused Zeners
- Zener Impedance and Zener Voltage Specified for Low-Level Operation at I_{ZT} = 250 μA
- Low Leakage Current — I_R from 0.01 to 10 μA over Voltage Range

SILICON ZENER DIODES
(±5.0% TOLERANCE)

250 MILLIWATTS
1.8-100 VOLTS

SILICON OXIDE PASSIVATED JUNCTION



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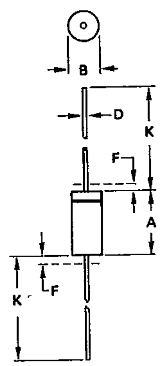
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
DC Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	250 1.43	mW mW/°C
Junction and Storage Temperature Range	T_J, T_{stg}	-65 to +200	°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



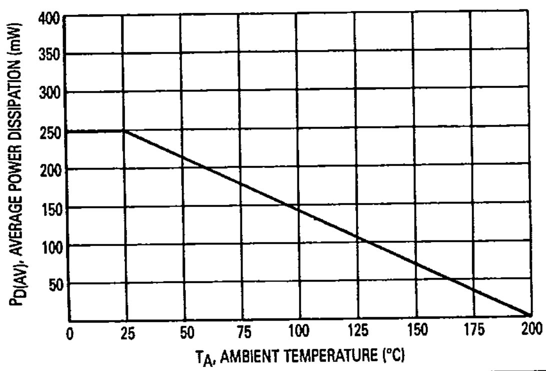
NOTES:
1. PACKAGE CONTOUR OPTIONAL WITHIN A AND B. HEAT SLUGS, IF ANY, SHALL BE INCLUDED WITHIN THIS CYLINDER, BUT NOT SUBJECT TO THE MINIMUM LIMIT OF B.
2. LEAD DIAMETER NOT CONTROLLED IN ZONE F TO ALLOW FOR FLASH, LEAD FINISH BUILDUP AND MINOR IRREGULARITIES OTHER THAN HEAT SLUGS.
3. POLARITY DENOTED BY CATHODE BAND.
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5, 1973.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	3.05	5.08	0.120	0.200
B	1.52	2.29	0.060	0.090
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 299-02
DO-204AH
GLASS

POWER TEMPERATURE DERATING CURVE



1N4099 thru 1N4135, 1N4614 thru 1N4627

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ELECTRICAL CHARACTERISTICS

(At 25°C Ambient temperature unless otherwise specified) I_{ZT} = 250 μA and V_F = 1.0 V max @ I_F = 200 mA on all Types

Type Number (Note 1)	Nominal Zener Voltage V_Z (Note 1) (Volts)	Max Zener Impedance Z_{ZT} (Note 2) (Ohms)	Max Reverse Current I_R (μA)	@ (Note 4)	Test Voltage V_R (Volts)	Max Noise Density At I_{ZT} = 250 μA N_D (Fig 1) (micro-volts per Square Root Cycle)	Max Zener Current I_{ZM} (Note 3) (mA)
1N4614	1.8	1200	7.5		1.0	1.0	120
1N4615	2.0	1250	5.0		1.0	1.0	110
1N4616	2.2	1300	4.0		1.0	1.0	100
1N4617	2.4	1400	2.0		1.0	1.0	95
1N4618	2.7	1500	1.0		1.0	1.0	90
1N4619	3.0	1600	0.8		1.0	1.0	85
1N4620	3.3	1650	7.5		1.5	1.0	80
1N4621	3.6	1700	7.5		2.0	1.0	75
1N4622	3.9	1650	5.0		2.0	1.0	70
1N4623	4.3	1600	4.0		2.0	1.0	65
1N4624	4.7	1550	10		3.0	1.0	60
1N4625	5.1	1500	10		3.0	2.0	55
1N4626	5.6	1400	10		4.0	4.0	50
1N4627	6.2	1200	10		5.0	5.0	45
1N4099	6.8	200	10		5.2	40	35
1N4100	7.5	200	10		5.7	40	31.8
1N4101	8.2	200	1.0		6.3	40	29.0
1N4102	8.7	200	1.0		6.7	40	27.4
1N4103	9.1	200	1.0		7.0	40	26.2
1N4104	10	200	1.0		7.6	40	24.8
1N4105	11	200	0.05		8.5	40	21.6
1N4106	12	200	0.05		9.2	40	20.4
1N4107	13	200	0.05		9.9	40	19.0
1N4108	14	200	0.05		10.7	40	17.5
1N4109	15	100	0.05		11.4	40	16.3
1N4110	16	100	0.05		12.2	40	15.4
1N4111	17	100	0.05		13.0	40	14.5
1N4112	18	100	0.05		13.7	40	13.2
1N4113	19	150	0.05		14.5	40	12.5
1N4114	20	150	0.01		15.2	40	11.9
1N4115	22	150	0.01		16.8	40	10.8
1N4116	24	150	0.01		18.3	40	9.9
1N4117	25	150	0.01		19.0	40	9.5
1N4118	27	150	0.01		20.5	40	8.8
1N4119	28	200	0.01		21.3	40	8.5
1N4120	30	200	0.01		22.8	40	7.9
1N4121	33	200	0.01		25.1	40	7.2
1N4122	36	200	0.01		27.4	40	6.6
1N4123	39	200	0.01		29.7	40	6.1
1N4124	43	250	0.01		32.7	40	5.5
1N4125	47	250	0.01		35.8	40	5.1
1N4126	51	300	0.01		38.8	40	4.6
1N4127	56	300	0.01		42.6	40	4.2
1N4128	60	400	0.01		45.6	40	4.0
1N4129	62	500	0.01		47.1	40	3.8
1N4130	68	700	0.01		51.7	40	3.5
1N4131	75	700	0.01		57.0	40	3.1
1N4132	82	800	0.01		62.4	40	2.9
1N4133	87	1000	0.01		66.2	40	2.7
1N4134	91	1200	0.01		69.2	40	2.6
1N4135	100	1500	0.01		76.0	40	2.3

NOTE 1: TOLERANCE AND VOLTAGE DESIGNATION

The type numbers shown have a standard tolerance of ±5.0% on the nominal zener voltage. C for ±2.0%, D for ±1%.

NOTE 2: ZENER IMPEDANCE (Z_{ZT}) DERIVATION

The zener impedance is derived from the 60 cycle ac voltage, which results when an ac current having an rms value equal to 10% of the dc zener current (I_{ZT}) is superimposed on I_{ZT}.

NOTE 3: MAXIMUM ZENER CURRENT RATINGS (I_{ZM})

Maximum zener current ratings are based on maximum zener voltage of the individual units.

NOTE 4: REVERSE LEAKAGE CURRENT I_R

Reverse leakage currents are guaranteed and are measured at V_R as shown on the table.

ZENER NOISE DENSITY

A zener diode generates noise when it is biased in the zener direction. A small part of this noise is due to the internal resistance associated with the device. A larger part of zener noise is a result of the zener breakdown phenomenon and is called microplasma noise. This microplasma noise is generally considered "white" noise with equal amplitude for all frequencies from about zero cycles to approximately 200,000 cycles. To eliminate the higher frequency components of noise a small shunting capacitor can be used. The lower frequency noise generally must be tolerated since a capacitor required to eliminate the lower frequencies would degrade the regulation properties of the zener in many applications.

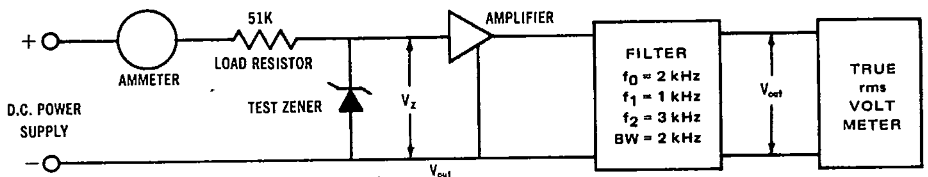
Motorola is rating this series with a maximum noise density at 250 microamperes. The rating of microvolts RMS per square root cycle enables calculation of the maximum RMS noise for any bandwidth.

Noise density decreases as zener current increases. This can be seen by the graph in Figure 2 where a typical noise density is plotted as a function of zener current.

The junction temperature will also change the zener noise levels. Thus the noise rating must indicate bandwidth, current level and temperature.

The block diagram given in Figure 1 shows the method used to measure noise density. The input voltage and load resistance is high so that the zener is driven from a constant current source. The amplifier must be low noise so that the amplifier noise is negligible compared to the test zener. The filter bandpass is known so that the noise density in volts RMS per square root cycle can be calculated.

FIGURE 1 – NOISE DENSITY MEASUREMENT METHOD



$$\text{NOISE DENSITY (VOLTS PER SQUARE ROOT CYCLE)} = \frac{V_{out}}{\text{OVERALL GAIN} \sqrt{BW}}$$

WHERE: BW = FILTER BANDWIDTH (CYCLES)

V_{out} = OUTPUT NOISE (VOLTS RMS)

FIGURE 2 – TYPICAL NOISE DENSITY versus ZENER CURRENT

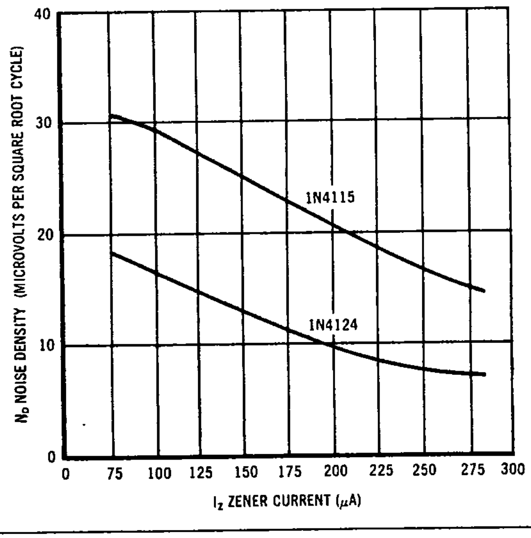


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FIGURE 3 — TYPICAL CAPACITANCE

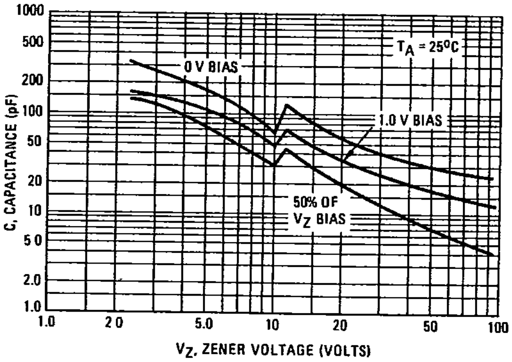
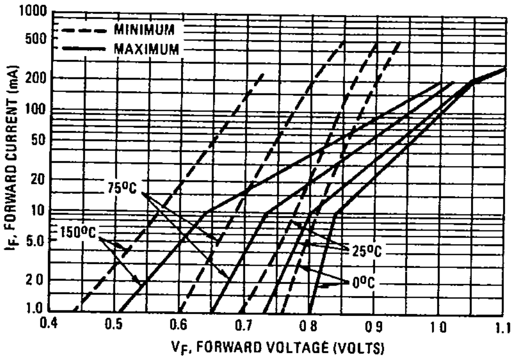


FIGURE 4 — TYPICAL FORWARD CHARACTERISTICS



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