Description/Features

TRANZAP's are silicon PN junction diodes designed, manufactured and specified as Transient Voltage Suppressors having a non-linear current-voltage characteristic which sustains an almost constant voltage over a wide range of current. They are ideally suited to many transient voltage protection applications and their high clamping efficiency and low steady state power dissipation offer considerable circuit advantages over most existing methods of protection.

During operation, the ZAP idles at a low current level at the nominal voltage. When a transient voltage occurs, ZAP current increases rapidly, its voltage remaining virtually constant, and the transient energy content is thus absorbed.

Features

- High surge current capability
- Excellent voltage clamping (1.2 @ 50% peak power)
- Symmetrical characteristic - use on AC or DC (bipolar)
- Instantaneous response (pico-second order)
- Low idling current (5μ-Amps)

Applications

- Protection of all types of semiconductors
- Absorption of surges associated with lightning
- Suppression of switching surges
- Protection in inductive switching circuits
- Prolongation of contact life
- Voltage clipping

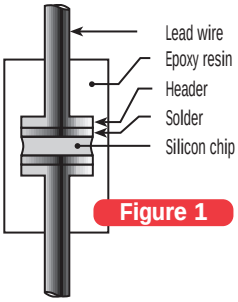


Figure 1

Construction

ZAP construction features PN junctions on both faces of a silicon chip and has been sufficiently designed for thermal dissipation of high surge power in a short period of time.

Surge suppression characteristics

Surge suppression is shown in Figure 2 when standard surge is applied to test circuit of Figure 3.

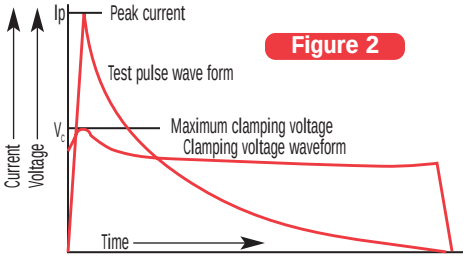


Figure 2

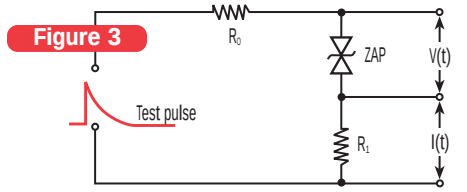


Figure 3

Electrical characteristics

Figure 4 shows an almost symmetrical breakdown voltage (V_B) ratio between forward (V_{BF}) and reverse breakdown voltage (V_{BR}).

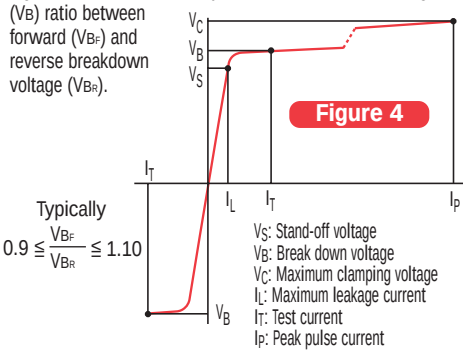


Figure 4

Stand-off voltage

TRANZAP's are designed for transient voltage suppression, it is not preferable to consume power at the operating voltage. Stand-off voltage is fixed to be of a value 0.9 times the minimum breakdown voltage.

Leakage current

The current when the stand-off voltage is applied is fixed as the maximum leakage current. This leakage current is an important factor when used in circuits with high impedance.

Breakdown voltage

The terminal voltage when a test current is passed, is fixed to be the breakdown voltage. The breakdown voltage is measured in air 25°C. The test current is normally 1 mA.

Continuous operating power

The PN junction temperature is determined by the following equation:

Tj = (PΘ) + Ta
P: Applied power
Thermal resistance
Ta: Ambient temperature

Where, Θ is thermal resistance from the PN junction to ambient space and is determined by following equation:

$\Theta = (^{1}/_{K}) \times (^{L}/_{S})$
K: Thermal conductivity
L: Length of lead wire
S: Sectional area of lead wire

In case of Ta = 50°C, Tj = 150°C, the maximum operating power is as follows:

Z1 type: 500m Watts
Z2 type: 1 Watt
Z6 type: 3 Watts

Surge capability

Surge capability (P) is determined by the following equation:

$P = \int i(t)(V(t)dt)$
it : Pulse current wave
Vt : clamping voltage wave

Allowable surge capability (Pm) is determined by the following equation:

$Pm = I_P \times V_C$
I_P : Peak current
V_C : Maximum clamping voltage

The allowable surge capability (peak pulse power) is as shown in Figure 5 and the surge capability derating characteristic as shown in Figure 6.

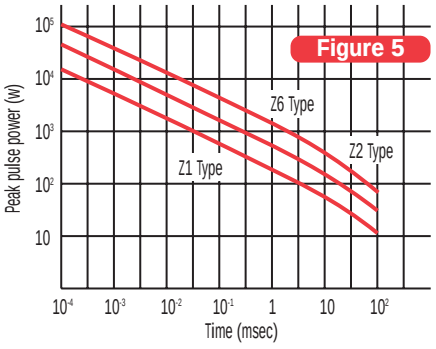


Figure 5

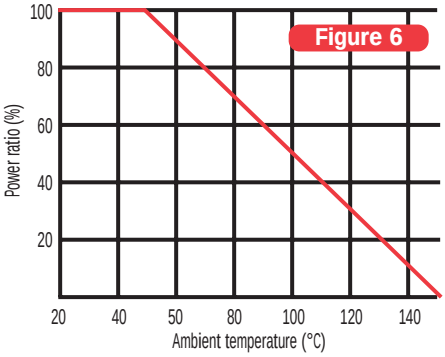


Figure 6

Repetitive surge capability

Peak pulse power is fixed under non-repetitive conditions. However, in practical use, there are cases when the surge is often repeatedly applied.
In this case, even though the one pulse power remains within the peak pulse power, the power is accumulative and exceeds the peak pulse power in some cases.

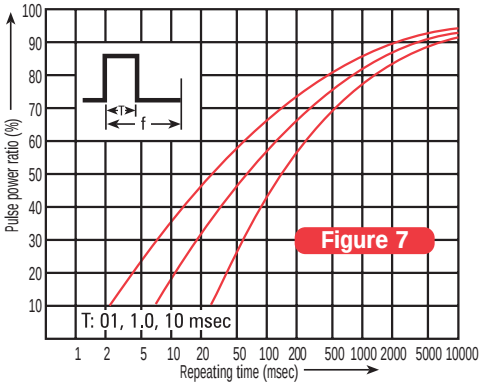


Figure 7

Response time

Response time of psec order however, in its operating response time, it depends largely on the influence of capacitance, and the effect of the response time with respect to the clamping voltages is negligible.

Capacitance

Capacitance is determined by the area of a silicon chip and the breakdown voltage. The capacitance decreases as the bias voltage increases as shown in Figure 8.

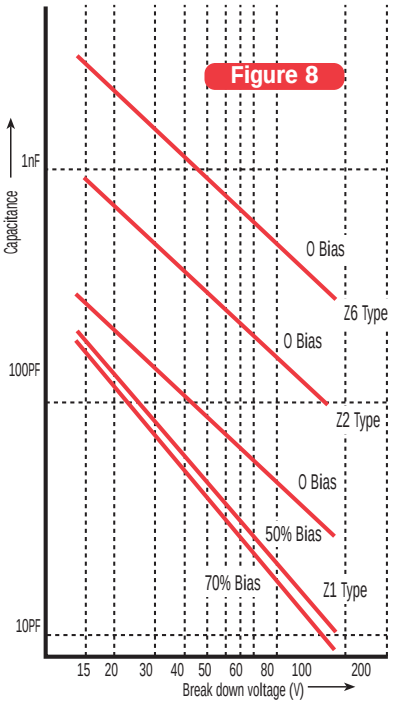


Figure 8

Taping

Standard taping is available upon request.

Forming

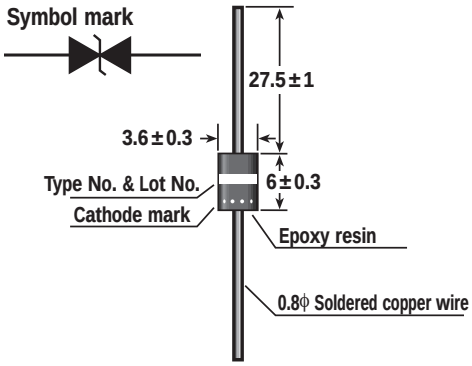
Standard forming is available upon request.

Z1 type (Bidirectional)

Maximum ratings

Peak pulse power: 250 watt (10 x 1,000 μsec)
3.03 KWatt (8 x 20 μsec)
Steady state power dissipation:
500 mWatts
Operating and storage temperature:
-40°C to 150°C

Symbol mark



Bi-polar type	Stand-off voltage V_S V	Maximum leakage current I_L	Breakdown voltage V_B	Test current I_T mA	Maximum clamping voltage & Maximum peak pulse current 10/1000 μsec V_C V	10/1000 μsec I_P A	8/20 μsec V_C V	8/20 μsec I_P A	Max temp. coef. of V_B %/°C
Z1015	12.1	5	13.5–16.5	1	22.0	11.4	28.5	106	0.076
Z1018	14.5	5	16.2–19.8	1	26.5	9.43	34.4	88.0	0.079
Z1022	17.8	5	19.8–24.2	1	31.9	7.84	41.4	73.1	0.082
Z1027	21.8	5	24.3–29.7	1	39.1	6.39	50.7	59.7	0.085
Z1033	26.8	5	29.7–36.3	1	47.7	5.24	61.8	49.0	0.087
Z1039	31.6	5	35.1–42.9	1	56.4	4.43	73.1	41.4	0.090
Z1047	38.1	5	42.3–51.7	1	67.8	3.69	88.1	34.4	0.092
Z1056	45.4	5	50.4–61.6	1	80.5	3.11	10.4	29.1	0.094
Z1068	55.1	5	61.2–74.8	1	98.0	2.55	127	23.8	0.096
Z1082	66.4	5	73.8–90.2	1	118	2.12	153	19.8	0.099
Z1100	81.0	5	90.0–110	1	144	1.74	187	16.2	0.101
Z1120	97.2	5	108–132	1	173	1.45	224	13.5	0.103
Z1150	121	5	135-165	1	215	1.16	279	10.8	0.105

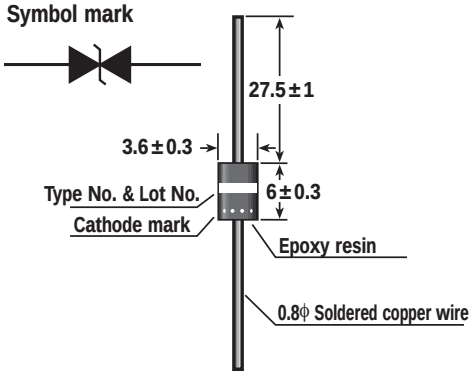
Vz ± 10% and Bi-polar

Z2 type

Maximum ratings

Peak pulse power: 600 Watt (10/1,000μsec)
7.28 KWatt (8/20μsec)
Steady state power dissipation:
1 Watt
Operating and storage temperature:
-40°C to 150°C

Symbol mark



Bi-polar type	Uni-polar type	Stand-off voltage V_S V	Maximum leakage current I_L μA	Breakdown voltage V_B V	Test current I_T mA	Maximum clamping voltage & Maximum peak pulse current 10/1000 μsec V_C V	10/1000 μsec I_P A	8/20 μsec V_C V	8/20 μsec I_P A
Z2008	Z2008U	6.63	500	7.38–9.02	10	12.5	48.0	16.2	449
Z2010	Z2010U	8.10	10	9.00–11.0	1	15.0	40.0	19.4	375
Z2012	Z2012U	9.72	5	10.8–13.2	1	17.3	34.6	22.4	325
Z2015	Z2015U	12.1	5	13.5–16.5	1	22.0	27.2	28.5	255
Z2018	Z2018U	14.5	5	16.2–19.8	1	26.5	22.6	34.4	298
Z2022	Z2022U	17.8	5	19.8–24.2	1	31.9	18.8	41.4	175
Z2027	Z2027U	21.8	5	24.3–29.7	1	39.1	15.3	50.7	143
Z2033	Z2033U	26.8	5	29.7–36.3	1	47.7	12.5	61.8	117
Z2039	Z2039U	31.6	5	35.1–42.9	1	56.4	10.6	73.1	99.5
Z2047	Z2047U	38.1	5	42.3–51.7	1	67.8	8.84	78.9	92.2
Z2056	Z2056U	45.4	5	50.4–61.6	1	80.5	7.45	104	70.0
Z2068	Z2068U	55.1	5	61.2–74.8	1	98.0	6.12	127	60.6
Z2082	Z2082U	66.4	5	73.8–90.2	1	118	5.08	153	47.5
Z2100	Z2100U	81.0	5	90.0–110	1	144	4.16	187	38.9
Z2120	Z2120U	97.2	5	108–132	1	173	3.46	224	32.5
Z2150	Z2150U	121	5	135–165	1	215	2.79	279	26.0
Z2180	Z2180U	146	5	162–198	1	258	2.32	335	21.7

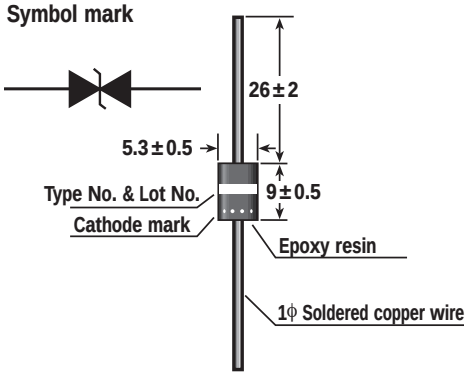
Note: Nonsuffix: Vz ± 10% and Bi-polar, suffix "U": Uni-polar

Z6 type

Maximum ratings

Peak pulse power: 1.5 KWatt (10 x 1,000μsec)
18.2 KWatt (8 x 20μsec)
Steady state power dissipation:
3 Watts
Operating and storage temperature:
-40°C to 150°C

Symbol mark



Bi-polar type	Uni-polar type	Stand-off voltage V_S V	Maximum leakage current I_L μA	Breakdown voltage V_B V	Test current I_T mA	Maximum clamping voltage & Maximum peak pulse current 10/1000 μsec V_C V	10/1000 μsec I_P A	8/20 μsec V_C V	8/20 μsec I_P A
–	Z6008U	6.63	500	7.38–9.02	10	12.5	120	16.2	1124
Z6010	Z6010U	8.10	10	9.00–11.0	1	15.0	100	19.4	938
Z6012	Z6012U	9.72	5	10.8–13.2	1	17.3	87	22.4	813
Z6015	Z6015U	12.1	5	13.5–16.5	1	22.0	68	28.5	639
Z6018	Z6018U	14.5	5	16.2–19.8	1	26.5	56	34.4	529
Z6022	Z6022U	17.8	5	19.8–24.2	1	31.9	47	41.4	440
Z6027	Z6027U	21.8	5	24.3–29.7	1	39.1	38	50.7	359
Z6033	Z6033U	26.8	5	29.7–36.3	1	47.7	31	61.8	295
Z6039	Z6039U	31.6	5	35.1–42.9	1	56.4	26	73.1	249
Z6047	Z6047U	38.1	5	42.3–51.7	1	67.8	22.2	78.9	231
Z6056	Z6056U	45.4	5	50.4–61.6	1	80.5	18.6	104	175
Z6068	Z6068U	55.1	5	61.2–74.8	1	98.0	15.3	127	143
Z6082	Z6082U	66.4	5	73.8–90.2	1	118	12.7	153	119
Z6100	Z6100U	81.0	5	90.0–110	1	144	10.4	187	97.4
Z6120	Z6120U	97.2	5	108–132	1	173	8.7	224	81.3
Z6150	Z6150U	121	5	135–165	1	215	7.0	279	65.2

Note: Nonsuffix: Vz ± 10% and Bi-polar, suffix "U": Uni-polar