MOTOROLA
SEMICONDUCTORS

P.O. BOX 20912 • PHOENIX, ARIZONA 85036

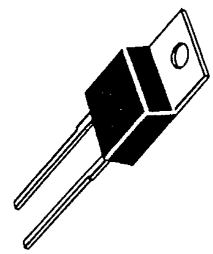
MZT2970 THRU MZT3015

10 WATT
ZENER TRANSIENT SUPPRESSORS
6.8 TO 200 V

10 WATT ZENER TRANSIENT SUPPRESSORS

The MZT2970 Series is designed to protect voltage sensitive components from high voltage and high energy transients. They have low zener impedance and fast response time. The highly reliable TO-220 package features low thermal resistance and high heat dissipation. This series is ideally suited for use in communication systems, numerical controls, process controls, medical equipment, business machines, power supplies and numerous other industrial/consumer applications.

- Voltage Range of 6.8 to 200 Volts
- Silicon Oxide Passivated Junctions
- 600 Watts Peak Power Rating @ 1.0 ms
- TO-220 Package



MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Steady State Power Dissipation @ T_C = 120°C Derate above T_C = 120°C	P_D	10 333	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +150	°C

MECHANICAL CHARACTERISTICS

CASE: TO-220

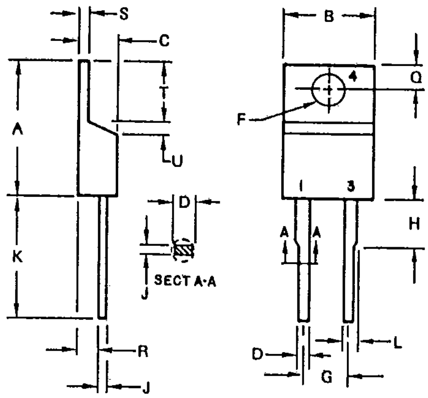
MAXIMUM LEAD TEMPERATURE FOR SOLDERING PURPOSES: 230°C, 1/16″ from case for 10 seconds

FINISH: Leads are corrosion resistant and readily solderable

POLARITY: Cathode to case

THERMAL CHARACTERISTICS

Thermal Resistance Junction to Case	$R_{\theta JC}$	3.0	°C/W
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	80	°C/W



STYLE 1:
PIN 1. CATHODE
2. N/A
3. ANODE
4. CATHODE

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	15.11	15.75	0.595	0.620
B	9.65	10.29	0.380	0.405
C	4.06	4.82	0.160	0.190
D	0.64	0.89	0.025	0.035
F	3.61	3.73	0.142	0.147
G	4.83	5.33	0.190	0.210
H	2.79	3.30	0.110	0.130
J	0.36	0.56	0.014	0.022
K	12.70	14.27	0.500	0.562
L	1.14	1.27	0.045	0.050
Q	2.54	3.04	0.100	0.120
R	2.04	2.79	0.080	0.110
S	1.14	1.39	0.045	0.055
T	5.97	6.48	0.235	0.255
U	0.76	1.27	0.030	0.050

CASE 221B-01
TO-220AC

ELECTRICAL CHARACTERISTICS (At T_C = 30°C unless otherwise specified. V_F = 1.5 V Max @ I_F = 2.0 Amps for all types.)

Device (Note 1)	Nominal Zener Voltage V_Z @ I_{ZT} Volts (Notes 1, 2, 3)	Test Current I_{ZT} mA	Max Zener Impedance (Note 4)			Max DC Zener Current I_{ZM} mA (Note 5)	Max. Reverse Current (Note 6)		
			Z_{ZT} @ I_{ZT} Ohms	Z_{ZK} @ I_{ZK} Ohms	I_{ZK} mA		I_R Max (μA)	V_{R1} 5%	V_{R2} 10%
MZT2970	6.8	370	1.2	500	1.0	1,320	150	5.2	4.9
MZT2971	7.5	335	1.3	250	1.0	1,180	75	5.7	5.4
MZT2972	8.2	305	1.5	250	1.0	1,040	50	6.2	5.9
MZT2973	9.1	275	2.0	250	1.0	960	25	6.9	6.6
MZT2974	10	250	3	250	1.0	860	10	7.6	7.2
MZT2975	11	230	3	250	1.0	780	5	8.4	8.0
MZT2976	12	210	3	250	1.0	720	5	9.1	8.6
MZT2977	13	190	3	250	1.0	660	5	9.9	9.4
MZT2978	14	180	3	250	1.0	600	5	10.6	10.1
MZT2979	15	170	3	250	1.0	560	5	11.4	10.8
MZT2980	16	155	4	250	1.0	530	5	12.2	11.5
MZT2982	18	140	4	250	1.0	460	5	13.7	13.0
MZT2983	19	130	4	250	1.0	440	5	14.4	13.7
MZT2984	20	125	4	250	1.0	420	5	15.2	14.4
MZT2985	22	115	5	250	1.0	380	5	16.7	15.8
MZT2986	24	105	5	250	1.0	350	5	18.2	17.3
MZT2988	27	95	7	250	1.0	300	5	20.6	19.4
MZT2989	30	85	8	300	1.0	280	5	22.8	21.6
MZT2990	33	75	9	300	1.0	260	5	25.1	23.8
MZT2391	36	70	10	300	1.0	230	5	27.4	25.9
MZT2992	39	65	11	300	1.0	210	5	29.7	28.1
MZT2993	43	60	12	400	1.0	195	5	32.7	31.0
MZT2995	47	55	14	400	1.0	175	5	35.8	33.8
MZT2996	50	50	15	500	1.0	165	5	38.0	36.0
MZT2997	51	50	15	500	1.0	163	5	38.8	36.7
MZT2998	52	50	15	500	1.0	160	5	39.5	37.4
MZT2999	56	45	16	500	1.0	150	5	42.6	40.3
MZT3000	62	40	17	600	1.0	130	5	47.1	44.6
MZT3001	68	37	18	600	1.0	120	5	51.7	49.0
MZT3002	75	33	22	600	1.0	110	5	56.0	54.0
MZT3003	82	30	25	700	1.0	100	5	62.2	59.0
MZT3004	91	28	35	800	1.0	85	5	69.2	65.5
MZT3005	100	25	40	900	1.0	80	5	76.0	72.0
MZT3006	105	25	45	1,000	1.0	75	5	79.8	75.6
MZT3007	110	23	55	1,100	1.0	72	5	83.6	79.2
MZT3008	120	20	75	1,200	1.0	67	5	91.2	86.4
MZT3009	130	19	100	1,300	1.0	62	5	98.8	93.6
MZT3010	140	18	125	1,400	1.0	58	5	106.4	100.8
MZT3011	150	17	175	1,500	1.0	54	5	114.0	108.0
MZT3012	160	16	200	1,600	1.0	50	5	121.6	115.2
MZT3014	180	14	260	1,850	1.0	45	5	136.8	129.6
MZT3015	200	12	300	2,000	1.0	40	5	152.0	144.0

NOTE 1. Tolerance:

The type numbers shown indicate a tolerance of ±20% with guaranteed limits on only V_Z, I_R and V_F as shown in the electrical characteristics table. Units with guaranteed limits on all six parameters are indicated by suffix "A" for ±10% tolerance and suffix "B" for ±5.0% units.

NOTE 2. Special Selections† Available Include:

1. Nominal zener voltages between those shown.
2. Two or more units for series connection with specified tolerance on total voltage. Series matched sets make zener voltages in excess of 200 volts possible as well as providing lower temperature coefficients, lower dynamic impedance and greater power handling ability.
3. Nominal voltages at non-standard test currents.

NOTE 3. Zener Voltage (V_Z) Measurement:

Nominal zener voltage is measured after the test current I_{ZT} has been applied for 1 ms while maintaining the case temperature at 30°C ± 1°C.

NOTE 4. Zener Impedance (Z_Z) Derivation:

Z_{ZT} and Z_{ZK} are measured by dividing the ac voltage drop across the device by the ac current applied. The specified limits are for I_Z(ac) = 0.1 × I_Z(dc) with the ac frequency = 1.0 kHz.

NOTE 5. Maximum Zener Current Ratings (I_{ZM}):

Maximum zener current ratings are based on maximum voltage of a 20% tolerance unit. For closer tolerance units (10% or 5%) or units where the actual zener voltage (V_Z) is known at the operating point, the maximum zener current may be increased and is limited by the derating curve.

NOTE 6. Reverse Leakage Current I_R:

Reverse leakage currents are guaranteed only for 5% and 10% 10 Watt silicon zener diodes and are measured at V_R as shown on the table.

SPECIAL DEVICES

Matched sets and back-to-back configurations for bi-directional applications can be ordered upon special request. Contact your nearest Motorola representative.

RESPONSE TIME

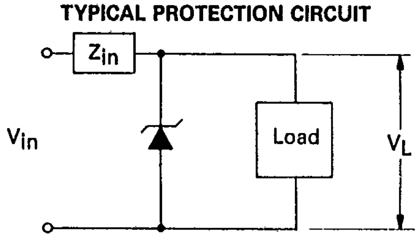
In most applications, the transient suppressor device is placed in parallel with the equipment or component to be protected. In this situation, there is a time delay associated with the capacitance of the device and an overshoot condition associated with the inductance of the device and the inductance of the connection method.

The capacitive effect is of minor importance in the parallel protection scheme because it only produces a time delay in the transition from the operating voltage to the clamp voltage as shown in Figure A.

The inductive effects in the device are due to actual turn-on time (time required for the device to go from zero current to full current) and lead inductance. This inductive effect produces an overshoot in the voltage across the equipment or component being protected as shown in Figure B. Minimizing this overshoot is very important in the application, since the main purpose for adding a transient suppressor is to clamp voltage spikes. The MZT2970 series has very good response time, typically <1.0 ns and negligible inductance. However, external inductive effects could produce unacceptable overshoot. Proper circuit layout, minimum lead lengths and placing the suppressor device as close as possible to the equipment or components to be protected will minimize this overshoot.

Some input impedance represented by Z_{in} is essential to prevent overstress of the protection device. This impedance should be as high as possible, without restricting the circuit operation.

TYPICAL PROTECTION CIRCUIT



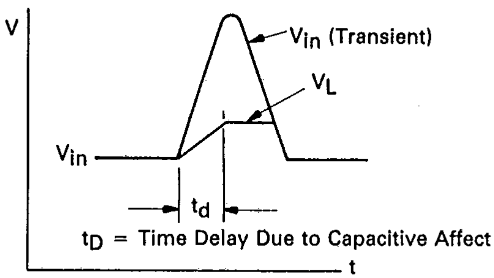


FIGURE A

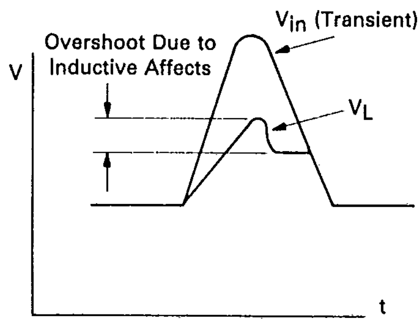


FIGURE B

FIGURE 1 — PULSE POWER RATING CURVE

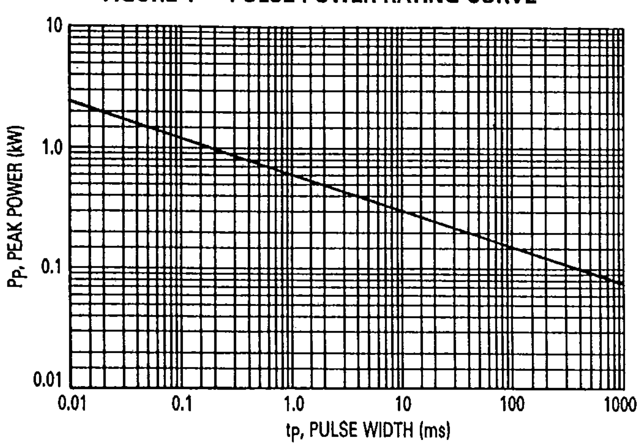


FIGURE 2 — POWER DERATING CURVE

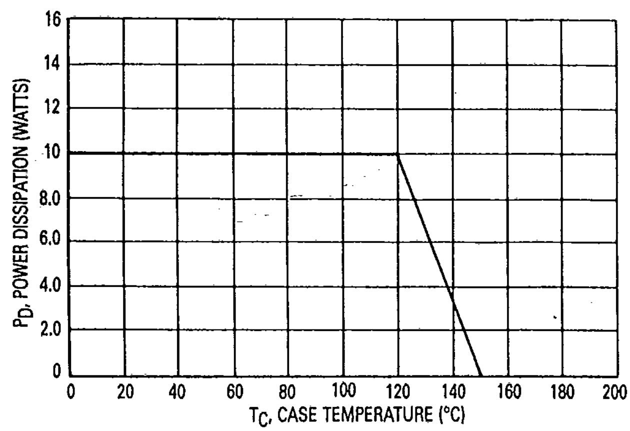


FIGURE 3 — PULSE WAVEFORM

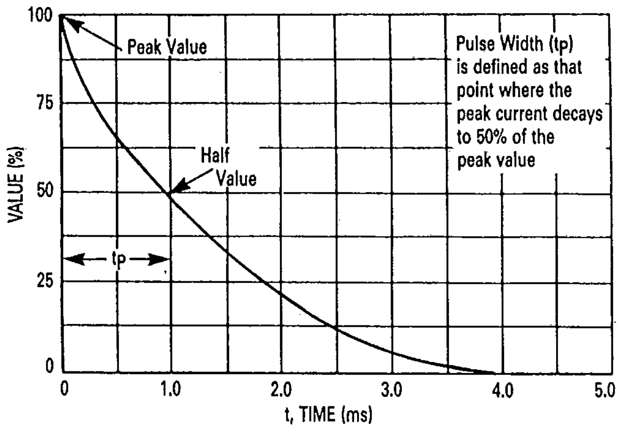


FIGURE 4 — TYPICAL REVERSE LEAKAGE CURRENT

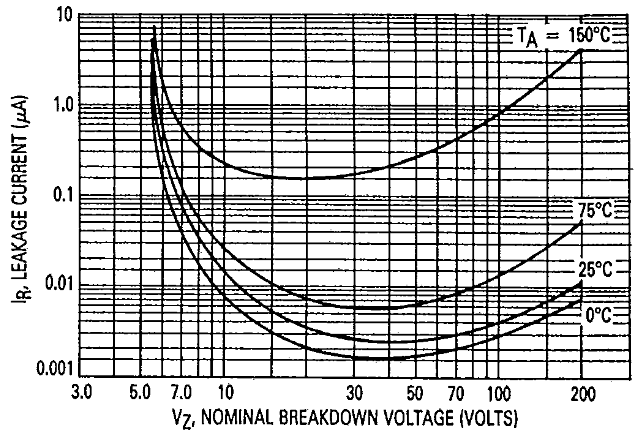
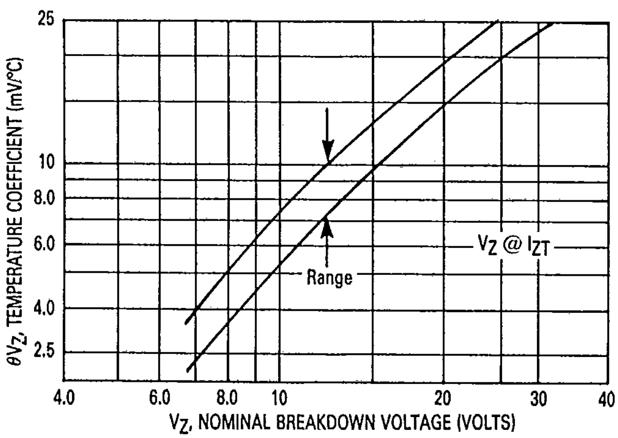


FIGURE 5 — TEMPERATURE COEFFICIENTS
(90% OF THE UNITS ARE IN THE RANGES INDICATED.)

A — RANGE FOR UNITS 6.8–24 VOLTS



B — RANGE FOR UNITS 24–200 VOLTS

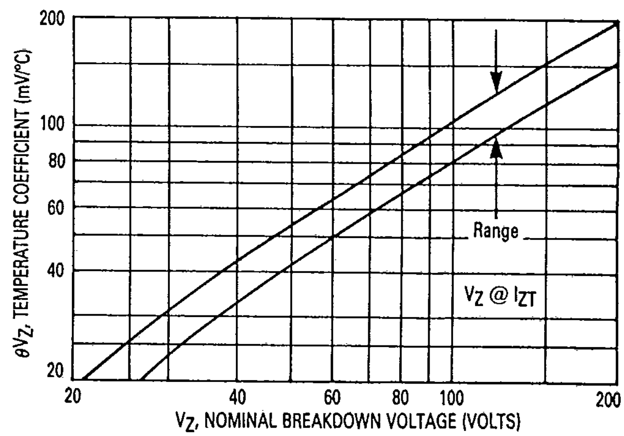


FIGURE 6 — TYPICAL ZENER IMPEDANCE AT TEST CURRENT