REGULATOR DIODES

Also available to BS9305–F049

A range of alloyed silicon diodes in DO-1 envelopes, intended for use as voltage regulator and transient suppressor diodes in medium power regulators and transient suppression circuits.

The series consists of the following types: BZY96-C4V7 to BZY96-C9V1.

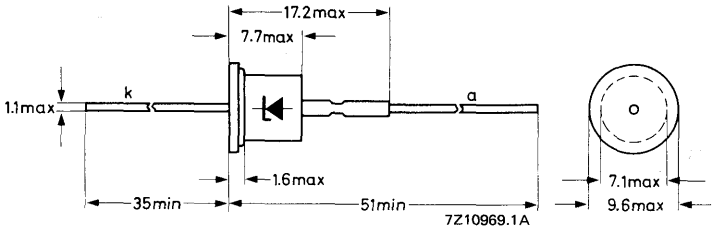
QUICK REFERENCE DATA

			voltage regulator	transient suppressor	
Working voltage (5% range)	V_Z	nom.	4,7 to 9,1	–	V
Stand-off voltage	V_R		–	3,6 to 6,8	V
Total power dissipation	P_{tot}	max.	2,5	–	W
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	–	190	W

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-1.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Peak working current	I_{ZM}	max.	3,5 A
Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	1 A
Non-repetitive peak reverse current T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse); BZY96-C4V7 to BZY96-C9V1	I_{RSM}	max.	22 to 12 A
Total power dissipation			
up to T_{amb} = 25 °C	P_{tot}	max.	2,5 W
at T_{amb} = 75 °C	P_{tot}	max.	1,67 W
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse)	P_{RSM}	max.	190 W
Storage temperature	T_{stg}		−65 to + 175 °C
Junction temperature	T_j	max.	175 °C

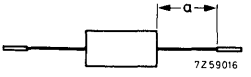
THERMAL RESISTANCE

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-points.

Thermal resistance from junction to ambient in free air:

mounted on soldering tags

at lead length a = 10 mm	$R_{th\ j\text{-}a}$ = 60 °C/W
at lead length a = maximum	$R_{th\ j\text{-}a}$ = 70 °C/W



mounted on a printed-circuit board

at lead length a = maximum	$R_{th\ j\text{-}a}$ = 80 °C/W
at lead length a = 10 mm	$R_{th\ j\text{-}a}$ = 90 °C/W

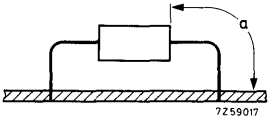


Fig. 2.

CHARACTERISTICS

Forward voltage I_F = 1 A; T_{amb} = 25 °C	V_F	<	1,5 V

CHARACTERISTICS

T_{amb} = 25 °C

WHEN USED AS VOLTAGE REGULATOR DIODES

WHEN USED AS TRANSIENT SUPPRESSOR DIODES

BZY96-...	working voltage *V_Z V		differential resistance *r_Z Ω		temperature coefficient *S_Z mV/°C	test I_Z mA	reverse current I_R μA at reverse voltage V_R V		clamping voltage $V_{(CL)R}$ V at t_p = 500 μs exp. pulse		non-repetitive peak reverse current I_{RSM} A	reverse current at recommended stand-off voltage I_R mA at V_R V		BZY96-...
	min.	max.	typ.	max.	typ.		max.		typ.	max.		max.		
C4V7	4.4	5.0	2.5	10	−0.6	100	20	1.0	6.5	7.8	10	2.0	3.6	C4V7
C5V1	4.8	5.4	1.0	5.0	−0.4	100	20	1.0	7.0	8.2	10	2.0	3.9	C5V1
C5V6	5.2	6.0	0.7	4.0	+1.0	100	20	1.0	7.5	8.8	10	0.2	4.3	C5V6
C6V2	5.8	6.6	0.6	3.0	+2.0	100	20	2.0	8.0	9.4	10	0.2	4.7	C6V2
C6V8	6.4	7.2	0.6	3.0	+3.0	100	20	2.0	8.5	10	10	0.2	5.1	C6V8
C7V5	7.0	7.9	1.0	3.5	+4.0	50	20	3.0	9.5	11	10	0.2	5.6	C7V5
C8V2	7.7	8.7	1.2	3.5	+5.0	50	20	5.6	11	13	10	0.1	6.2	C8V2
C9V1	8.5	9.6	1.8	4.5	+6.4	50	20	6.2	13	15	10	0.1	6.8	C9V1

*At test I_Z; using a pulse method with $t_p \leq 100$ μs and $\delta \leq 0.001$ so that the values correspond to a T_j of approximately 25 °C

OPERATION AS A VOLTAGE REGULATOR

Dissipation and heatsink considerations

a. Steady-state conditions

The maximum permissible steady-state dissipation $P_{s\,max}$ is given by the relationship

$$P_{s\,max} = \frac{T_{j\,max} - T_{amb}}{R_{th\ j\text{-}a}}$$

where: $T_{j\,max}$ is the maximum permissible operating junction temperature
T_{amb} is the ambient temperature
$R_{th\ j\text{-}a}$ is the total thermal resistance from junction to ambient

b. Pulse conditions (see Fig. 3)

The maximum permissible pulse power $P_{p\,max}$ is given by the formula

$$P_{p\,max} = \frac{(T_{j\,max} - T_{amb}) - (P_s \cdot R_{th\ j\text{-}a})}{R_{th\ t}}$$

Where: P_s is any steady-state dissipation excluding that in pulses
$R_{th\ t}$ is the effective transient thermal resistance of the device between junction and ambient. It is a function of the pulse duration t_p and duty factor δ.
δ is the duty factor (t_p/T)

The steady-state power P_s when biased in the zener direction at a given zener current can be found from Fig. 4. With the additional pulse power dissipation $P_{p\,max}$ calculated from the above expression, the total peak zener power dissipation $P_{tot} = P_{ZRM} = P_s + P_p$. From Fig. 4 the corresponding maximum repetitive peak zener current at P_{tot} can now be read. This repetitive peak zener current is subject to the absolute maximum rating. For pulse durations longer than the temperature stabilization time of the diode t_{stab}, the maximum permissible repetitive peak dissipation P_{ZRM} is equal to the steady-state power P_s. The temperature stabilization time for the BZY96 is 100 seconds (see Fig. 10).

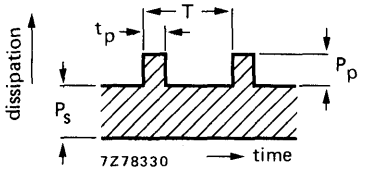


Fig. 3.

NOTES WHEN OPERATING AS A TRANSIENT SUPPRESSOR

1. The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.
2. The maximum clamping voltage is the maximum reverse voltage which appears across the diode at the specified pulse duration and junction temperature. For square pulses see Fig. 13 and for exponential pulses see Fig. 14.
3. Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that the energy content does not continue beyond twice this time.
4. Surge suppressor diodes are extremely fast in clamping, switching on in less than 5 ns.

SOLDERING AND MOUNTING INSTRUCTIONS

1. When using a soldering iron, diodes may be soldered directly into the circuit, but heat conducted to the junction should be kept to a minimum.
2. Diodes may be dip-soldered at a solder temperature of 245 °C for a maximum soldering time of 5 seconds. The case temperature during dip-soldering must not at any time exceed the maximum storage temperature. These recommendations apply to a diode with the anode end mounted flush on a printed-circuit board having punched-through holes. For mounting the anode end onto a printed-circuit board, the diode must be spaced at least 5 mm from the underside of the printed-circuit board having punched-through holes, or 5 mm from the top of the printed-circuit board having plated-through holes.
3. Care should be taken not to bend the leads nearer than 1,5 mm from the seal; exert no axial pull when bending.

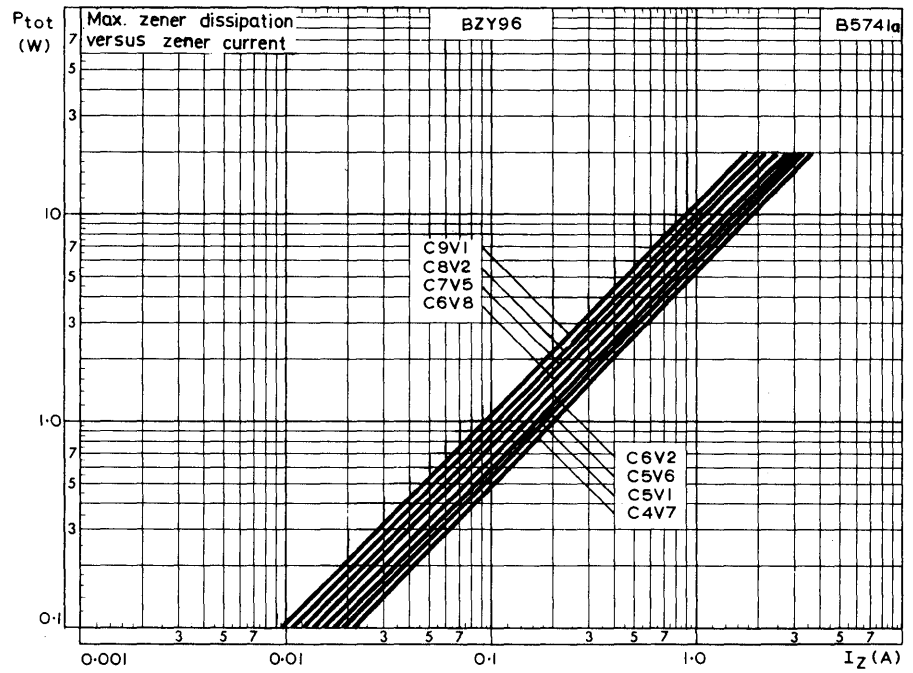


Fig. 4 Maximum permissible repetitive peak dissipation ($P_{tot} = P_{ZRM}$).

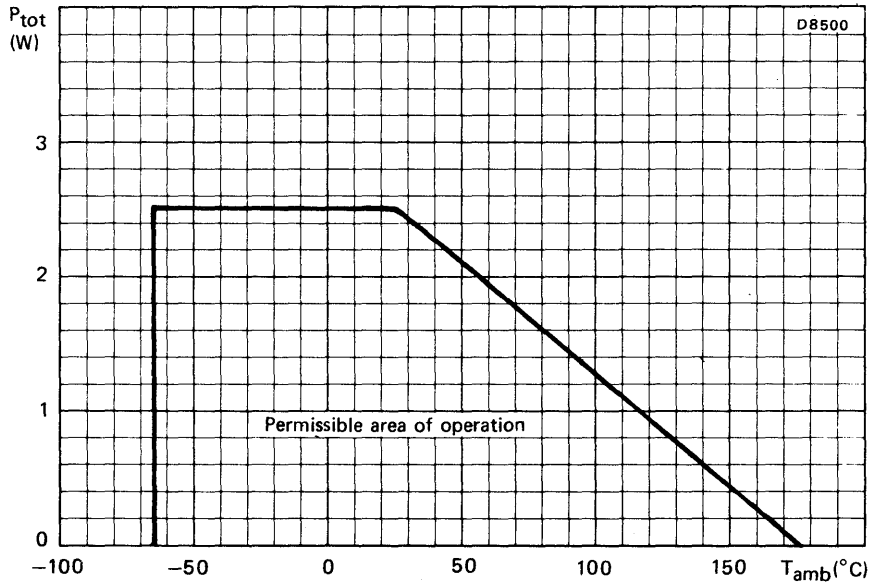


Fig. 5 Maximum permissible total power dissipation versus ambient temperature.

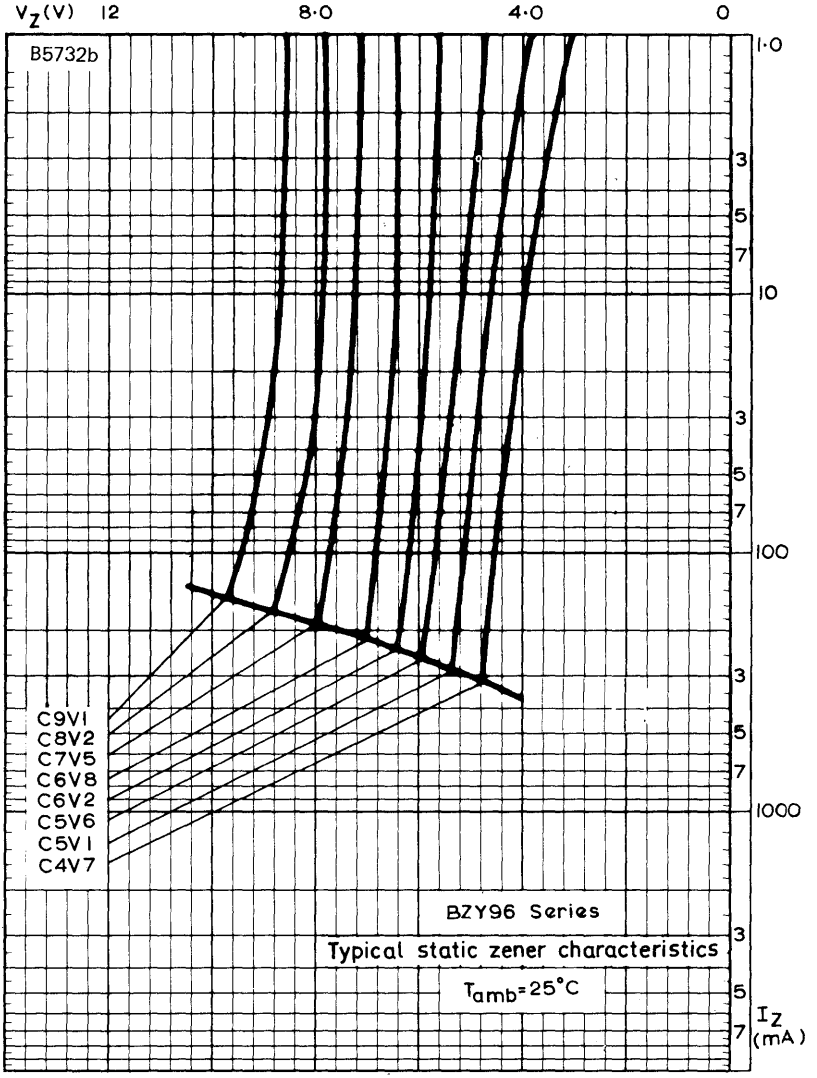


Fig. 6 Typical static zener characteristics.

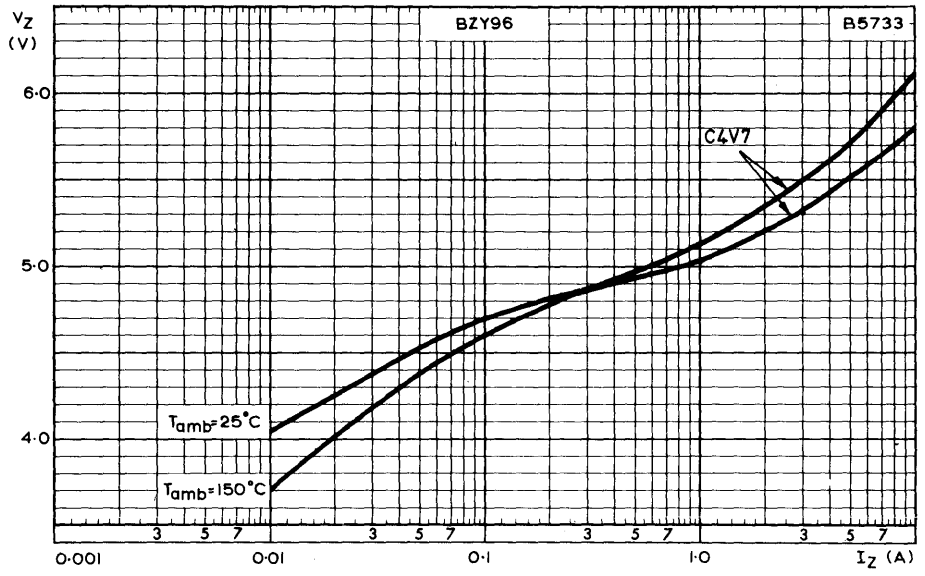


Fig. 7 Typical dynamic zener characteristics for BZY96-C4V7.

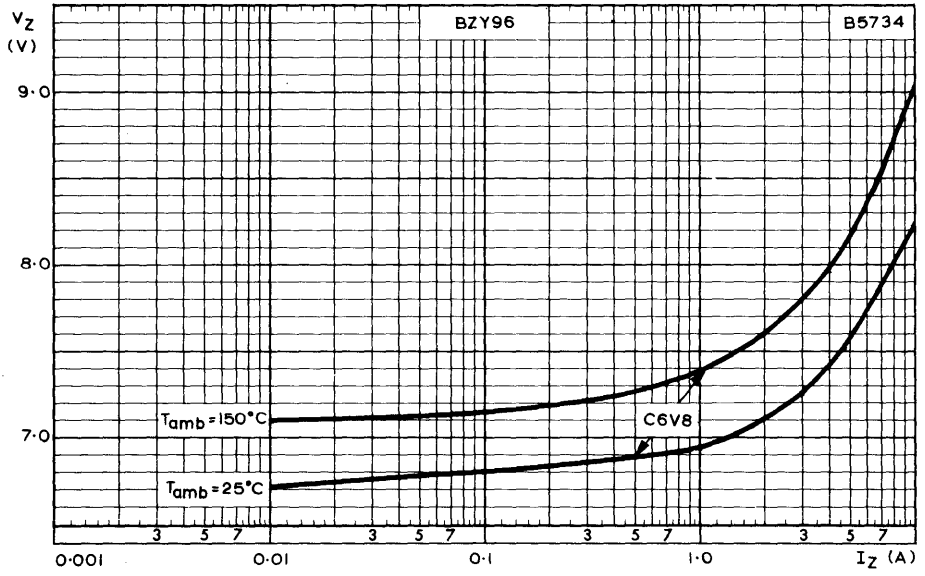


Fig. 8 Typical dynamic zener characteristics for BZY96-C6V8.

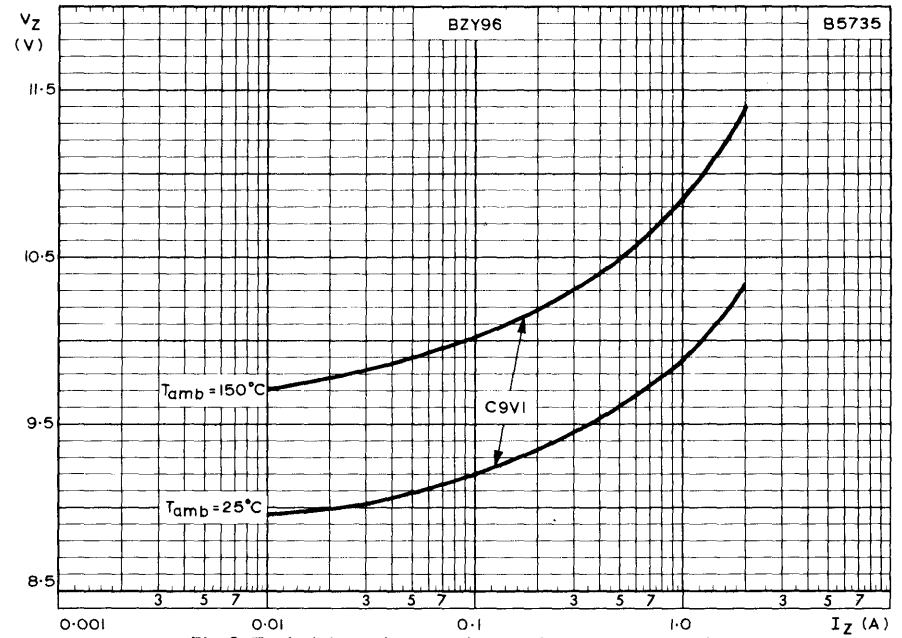


Fig. 9 Typical dynamic zener characteristics for BZY96-C9V1.

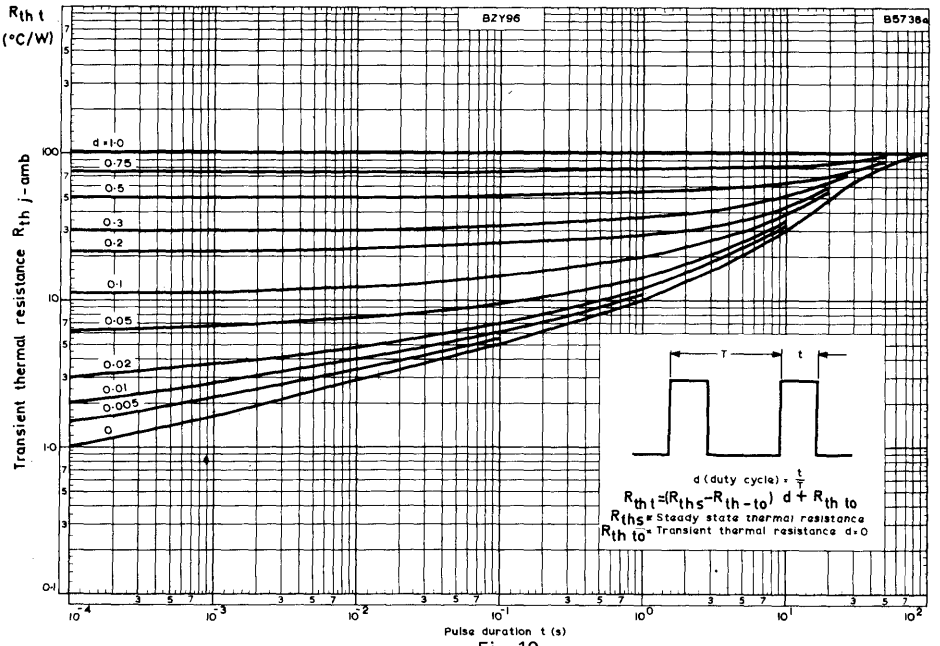


Fig. 10.

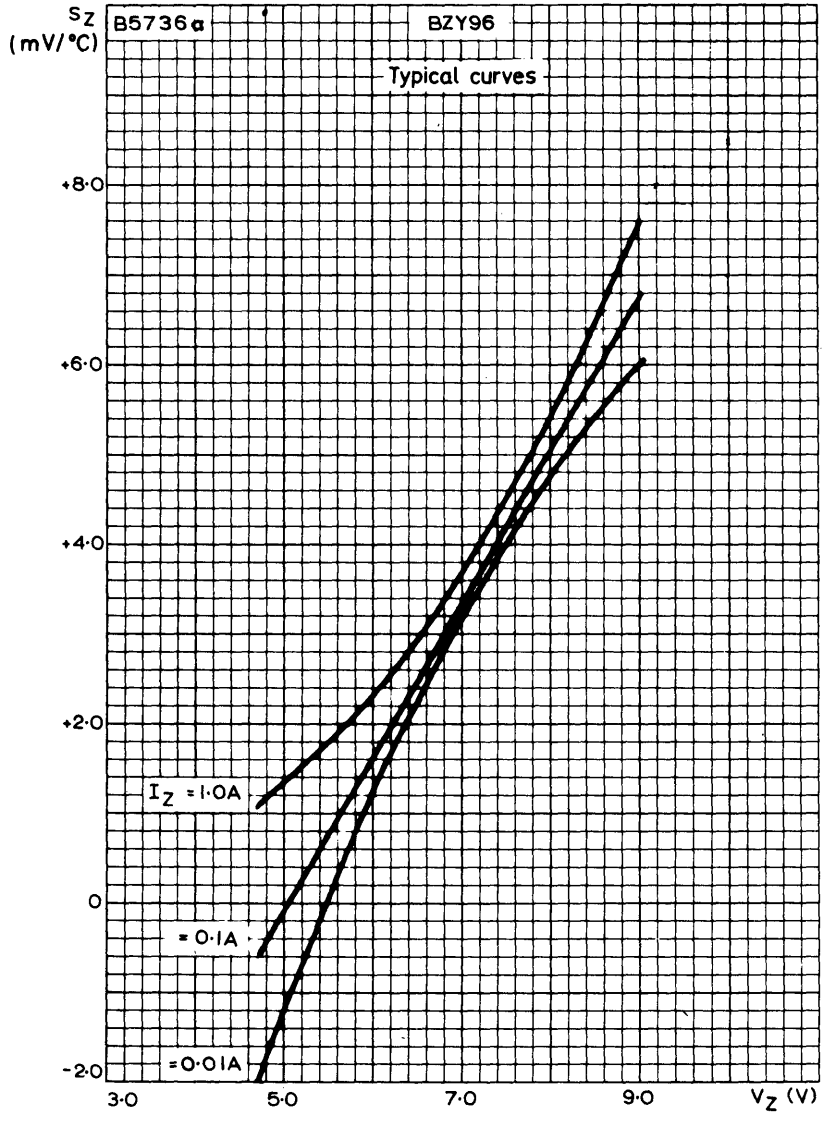

S_Z (mV/°C)
B5736a
BZY96
Typical curves
+8·0
+6·0
+4·0
+2·0
0
-2·0
I_Z = 1·0A
= 0·1A
= 0·01A
3·0
5·0
7·0
9·0
V_Z (V)

Fig. 11.

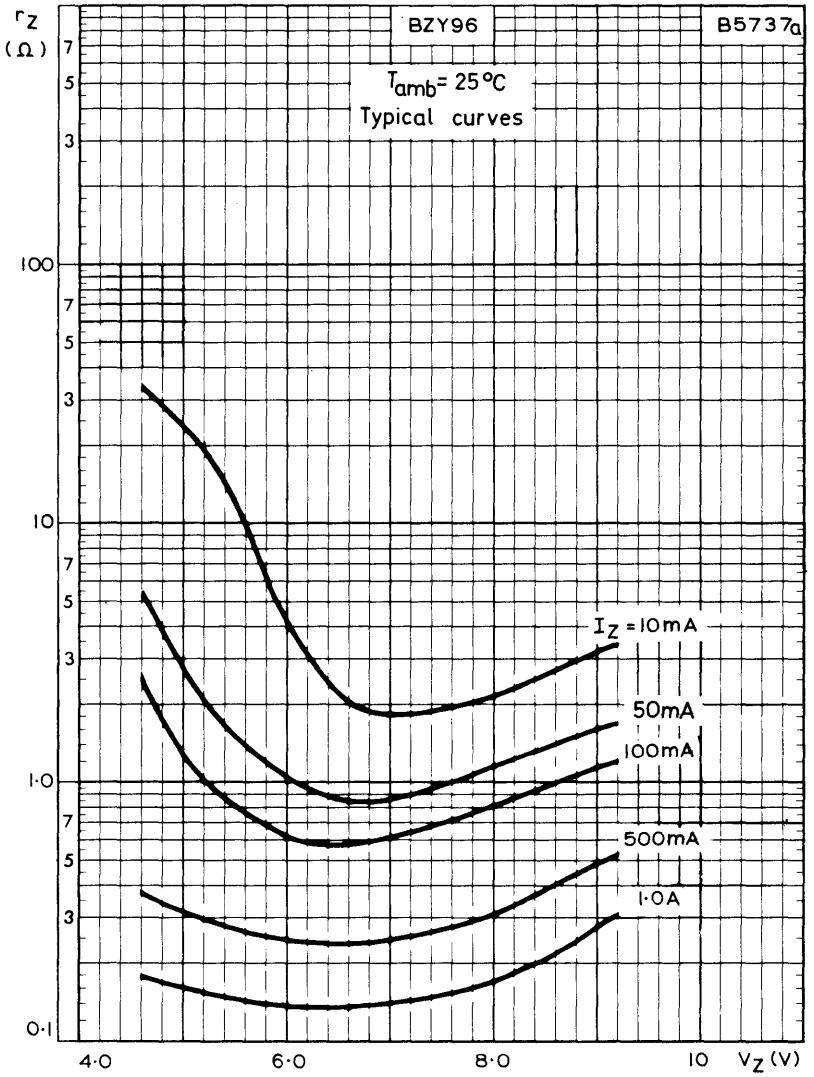

BZY96
B5737a
T_{amb}= 25 °C
Typical curves
r_Z (Ω)
100
10
1·0
0·1
I_Z = 10mA
50mA
100mA
500mA
1·0A
4·0
6·0
8·0
10
V_Z (V)

Fig. 12.

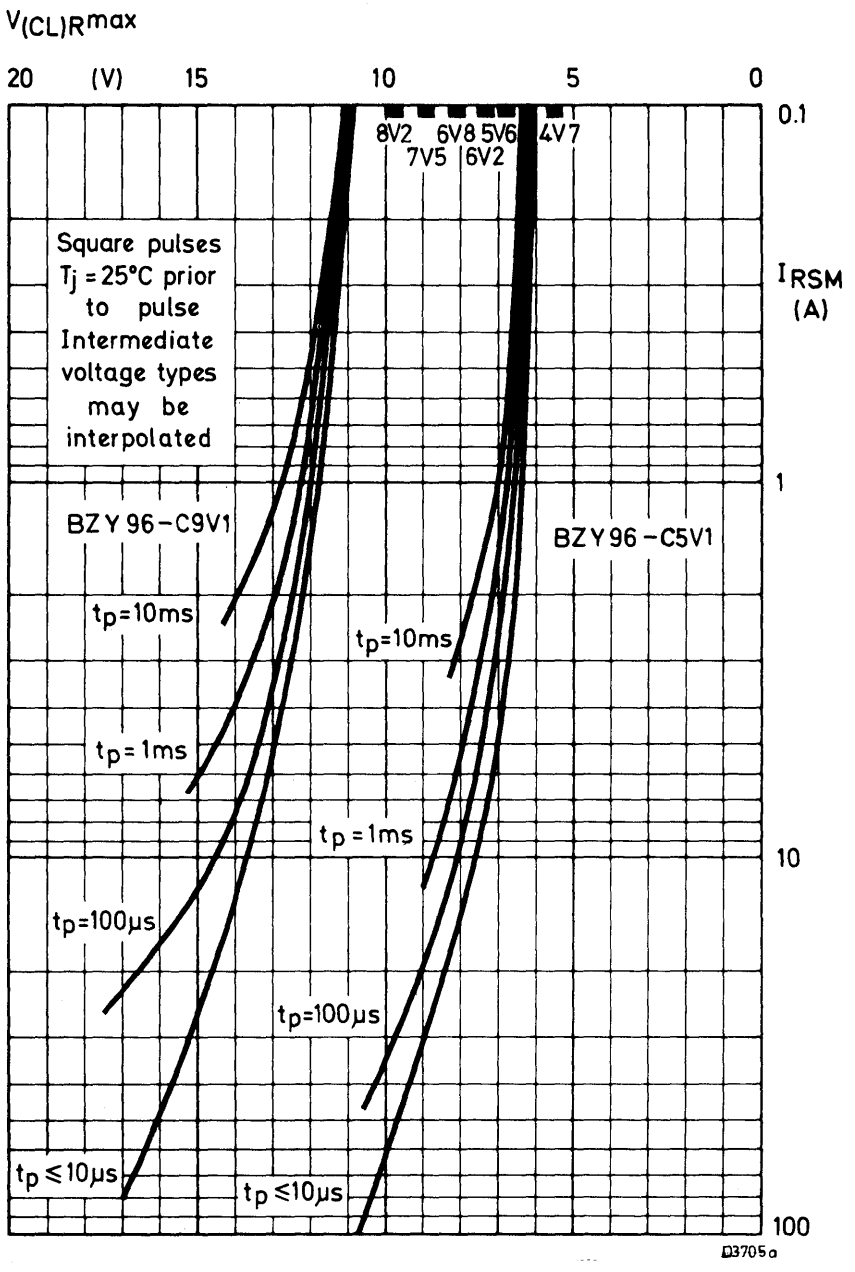

V(CL)R max
20
(V)
15
10
5
0
0.1
IRSM (A)
1
10
100
8V2
6V8
5V6
4V7
7V5
6V2
Square pulses
Tj = 25°C prior to pulse
Intermediate voltage types may be interpolated
BZY96-C9V1
BZY96-C5V1
tp=10ms
tp=10ms
tp=1ms
tp=1ms
tp=100µs
tp=100µs
tp≤10µs
tp≤10µs
D3705a

Fig. 13.

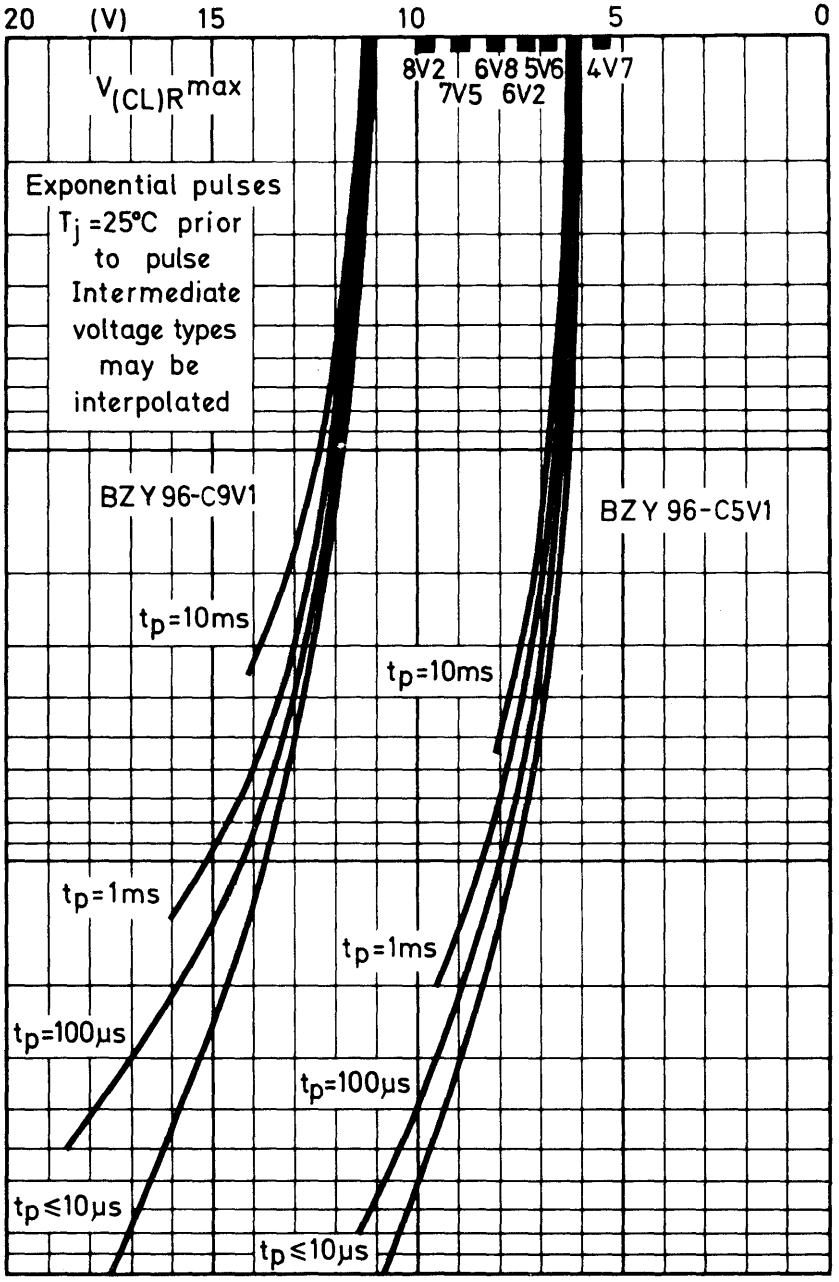


Fig. 14.

D3704a

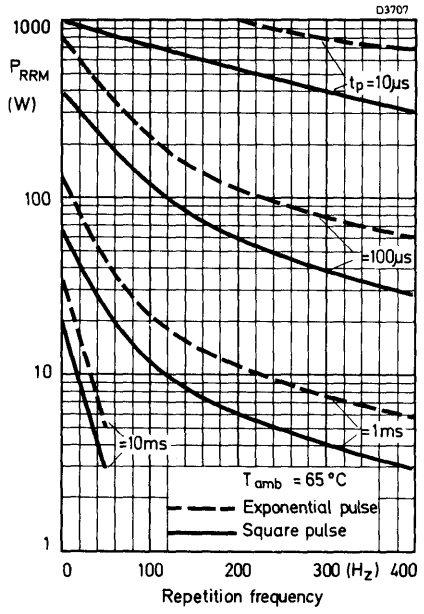


Fig. 15.

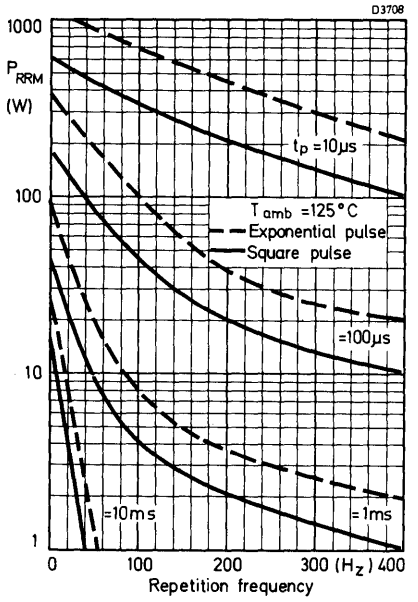


Fig. 16.

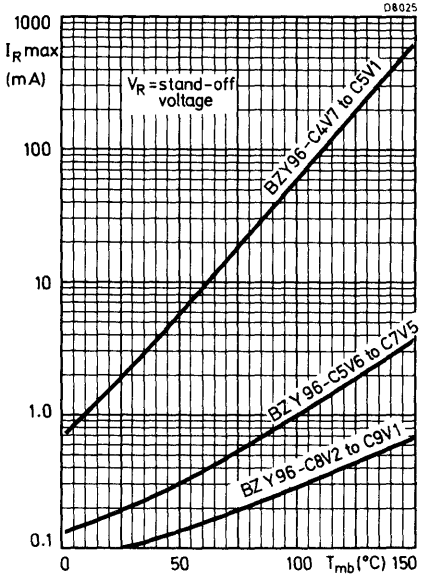


Fig. 17.

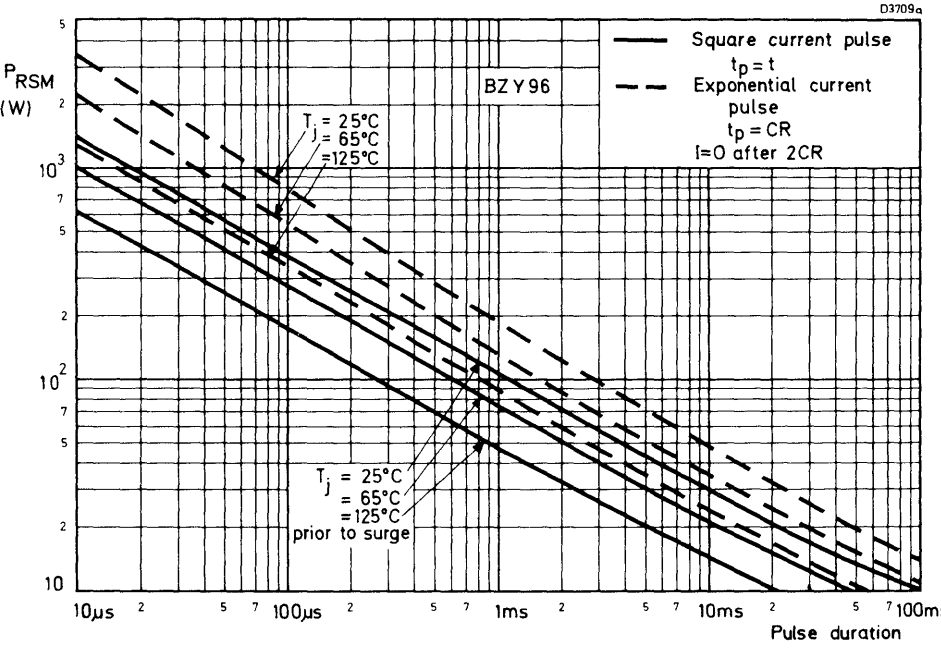

D3709a
Square current pulse
$t_p = t$
Exponential current pulse
$t_p = CR$
I=0 after 2CR
BZY96
P_{RSM} (W)
T_j = 25°C
= 65°C
=125°C
T_j = 25°C
= 65°C
=125°C
prior to surge
10µs
100µs
1ms
10ms
100ms
Pulse duration

Fig. 18.