REGULATOR DIODES

Also available to BS9305—F050

A range of diffused 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: BZY95-C10 to BZY95-C75.

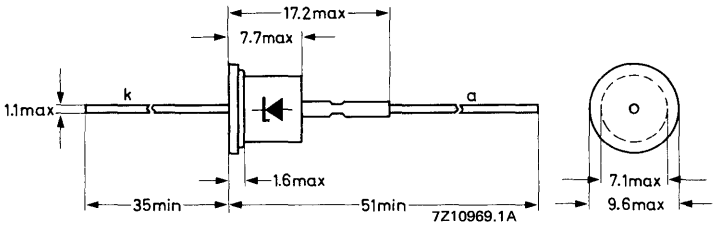
QUICK REFERENCE DATA

			voltage regulator	transient suppressor	
Working voltage (5% range)	V_Z	nom.	10 to 75	–	V
Stand-off voltage	V_R		–	7,5 to 56	V
Total power dissipation	P_{tot}	max.	2,5	–	W
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	–	700	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.	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); BZY95-C10 to BZY95-C75	I_{RSM}	max.	70 to 5	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.	700	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

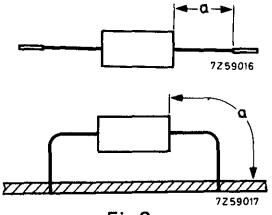


Fig.2

CHARACTERISTICS

Forward voltage

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

OPERATION AS A VOLTAGE REGULATOR (see page 4)

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 BZY95 is 100 seconds (see Fig. 10).

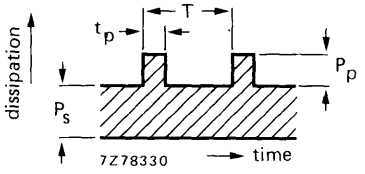


Fig. 3.

NOTES WHEN OPERATING AS A TRANSIENT SUPPRESSOR (see page 5)

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 Figs 14 and 15, for exponential pulses see Figs 16 and 17.
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.

CHARACTERISTICS – WHEN USED AS VOLTAGE REGULATOR DIODES; $T_{mb} = 25\ ^{o}C$

BZY95-. . .	working voltage *V_Z V		differential resistance *r_Z Ω		temperature coefficient *S_Z mV/°C	test I_Z mA	reverse current at I_R μA	reverse voltage V_R V
	min.	max.	typ.	max.	typ.		max.	
C10	9.4	10.6	0.75	4.0	7.0	50	10	6.8
C11	10.4	11.6	0.8	4.5	7.5	50	10	7.5
C12	11.4	12.7	0.85	5.0	8.0	50	10	8.2
C13	12.4	14.1	0.9	6.0	8.5	50	10	9.1
C15	13.8	15.6	1.0	8.0	10	50	10	10
C16	15.3	17.1	2.4	9.0	11	20	10	11
C18	16.8	19.1	2.5	11	12	20	10	12
C20	18.8	21.2	2.8	12	14	20	10	13
C22	20.8	23.3	3.0	13	16	20	10	15
C24	22.7	25.9	3.4	14	18	20	10	16
C27	25.1	28.9	3.8	18	20	20	10	18
C30	28	32	4.5	22	25	20	10	20
C33	31	35	5.0	25	30	20	10	22
C36	34	38	5.5	30	32	20	10	24
C39	37	41	12	35	35	10	10	27
C43	40	46	13	40	40	10	10	30
C47	44	50	14	50	45	10	10	33
C51	48	54	15	55	50	10	10	36
C56	52	60	17	63	55	10	10	39
C62	58	66	18	75	60	10	10	43
C68	64	72	18	90	65	10	10	47
C75	70	79	20	100	70	10	10	51

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

CHARACTERISTICS – WHEN USED AS TRANSIENT SUPPRESSOR DIODES; T_{mb} = 25 °C

clamping voltage at t_p = 500 μs exp. pulse $V_{(CL)R}$ V		non-repetitive peak reverse current I_{RSM} A	reverse current at recommended stand-off voltage I_R mA	V_R V	BZY95-. . .
typ.	max.		max.		
11	12.5	20	0.1	7.5	C10
12.3	14	20	0.1	8.2	C11
14	16	20	0.1	9.1	C12
15.3	17.5	20	0.1	10	C13
17	19.5	20	0.1	11	C15
19.3	22	20	0.1	12	C16
21	24	20	0.1	13	C18
23	27	10	0.1	15	C20
26	30	10	0.1	16	C22
29	34	10	0.1	18	C24
33	39	10	0.1	20	C27
38	44	10	0.1	22	C30
42	50	10	0.1	24	C33
47	56	10	0.1	27	C36
40	47	5	0.1	30	C39
45	52	5	0.1	33	C43
51	59	5	0.1	36	C47
57	66	5	0.1	39	C51
64	75	5	0.1	43	C56
73	85	5	0.1	47	C62
81	94	5	0.1	51	C68
90	105	5	0.1	56	C75

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.

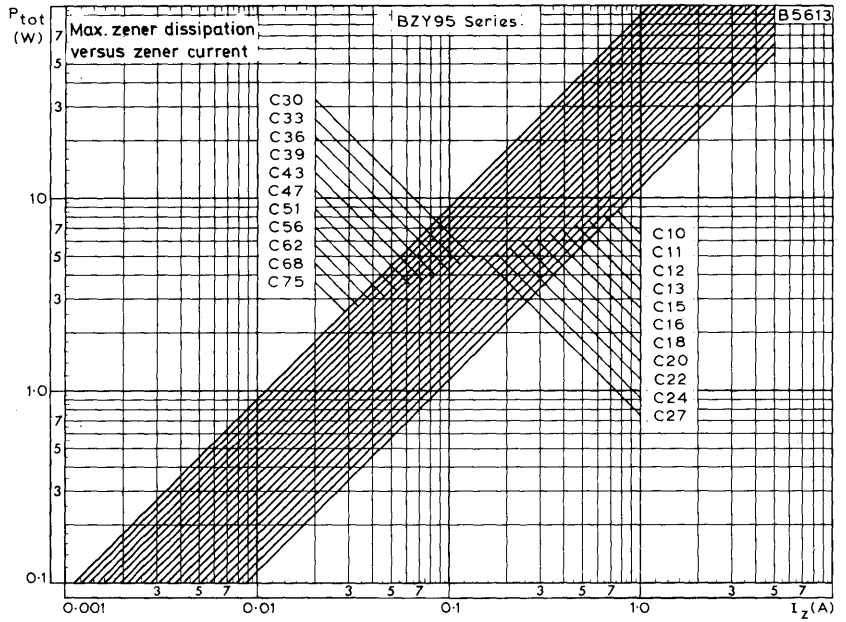


Fig. 4 Maximum permissible repetitive peak dissipation ($P_{tot} = P_{ZRM}$).

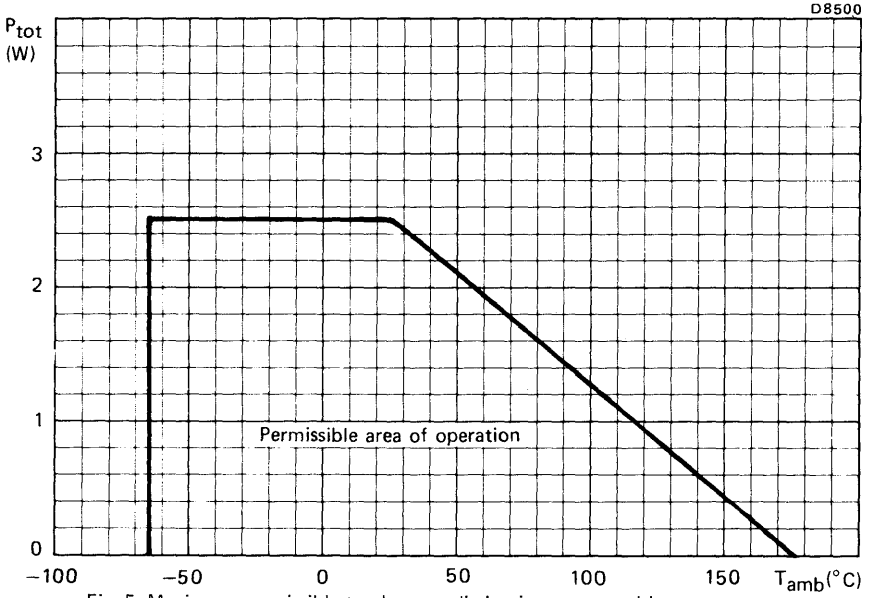


Fig. 5 Maximum permissible total power dissipation versus ambient temperature.

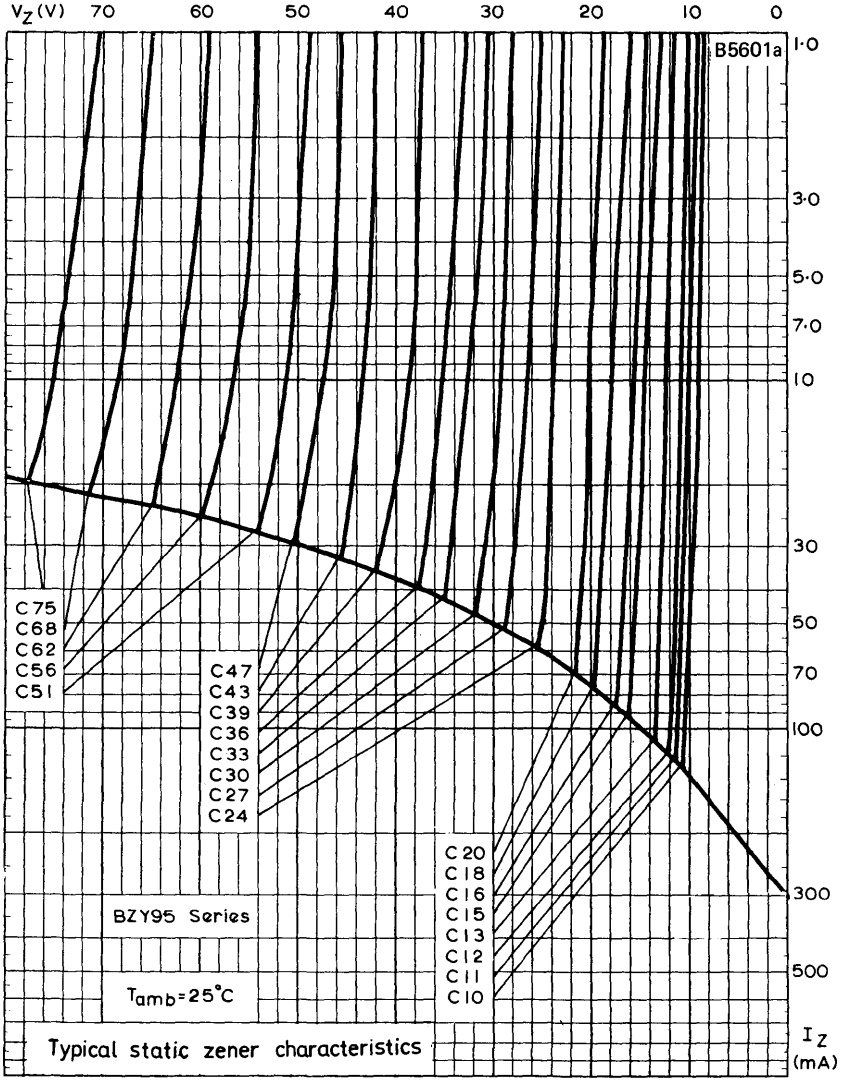


Fig. 6 Typical static zener characteristics.

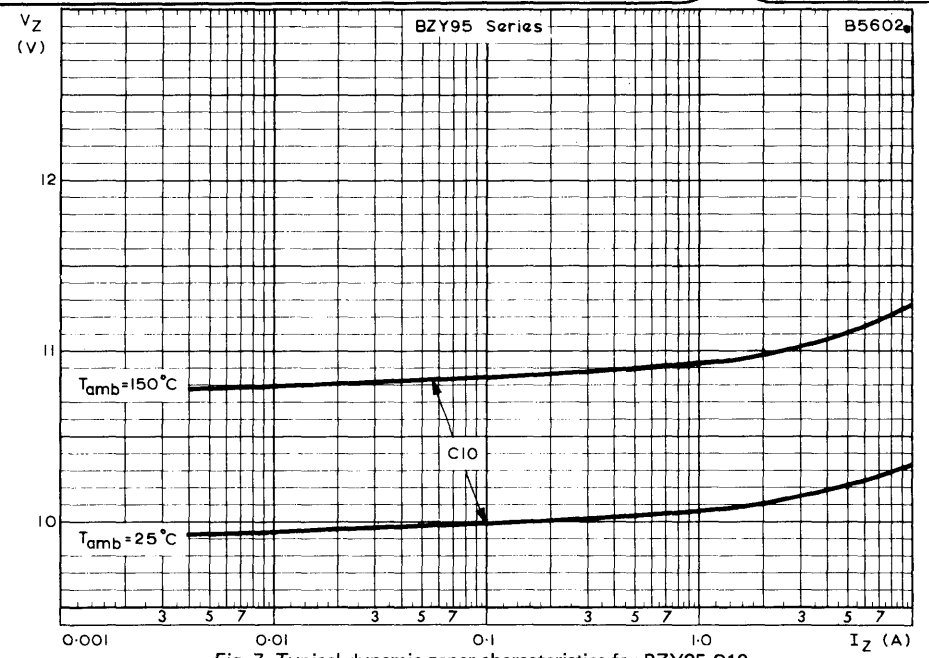


Fig. 7 Typical dynamic zener characteristics for BZY95-C10.

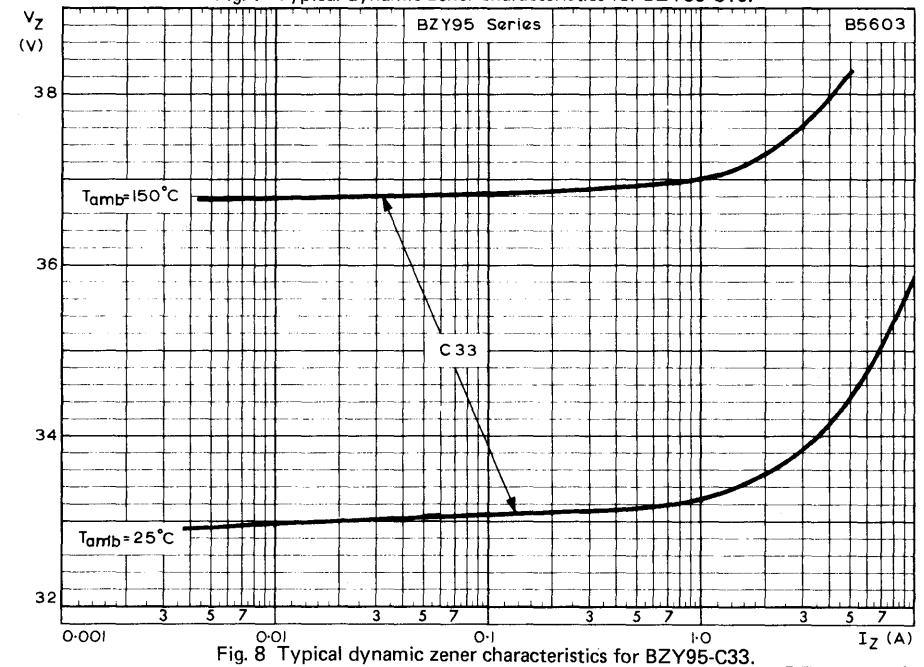


Fig. 8 Typical dynamic zener characteristics for BZY95-C33.

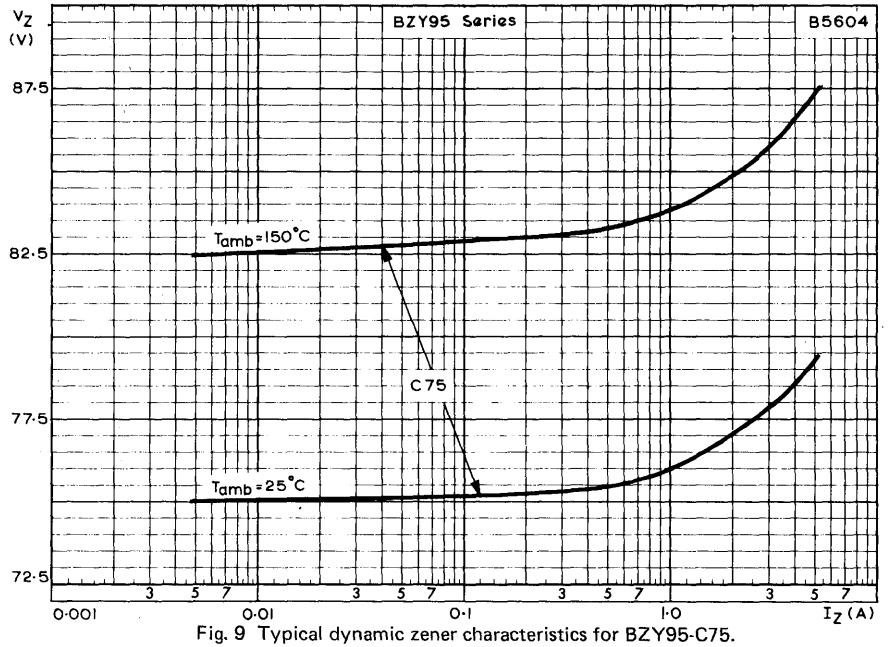


Fig. 9 Typical dynamic zener characteristics for BZY95-C75.

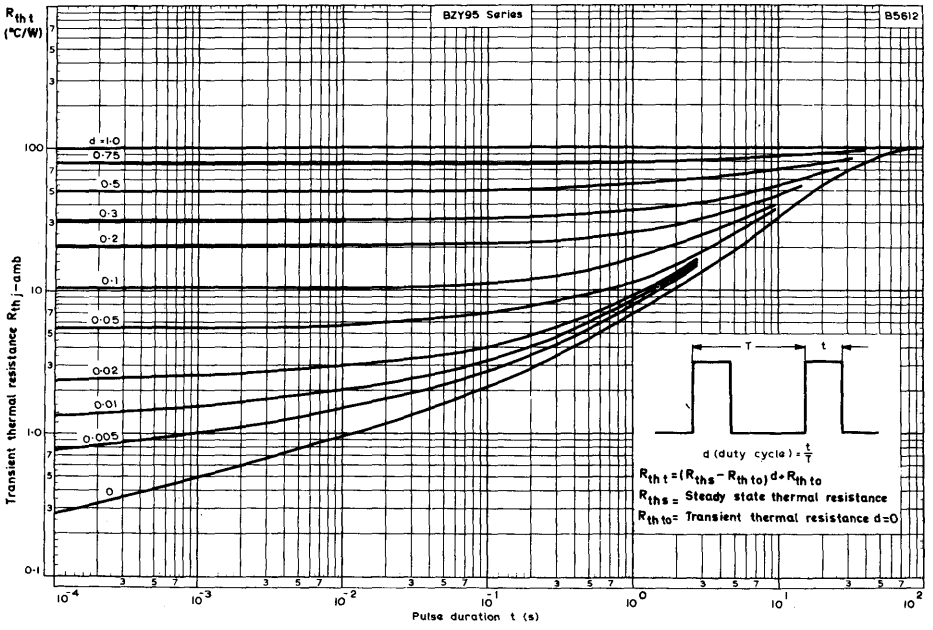


Fig. 10.

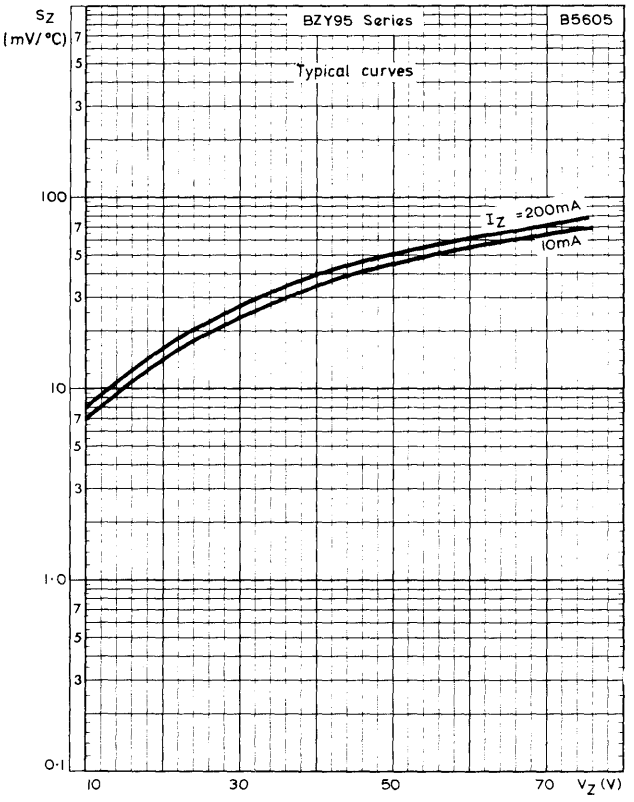

BZY95 Series
B5605
Typical curves
S_Z (mV/°C)
100
10
1·0
0·1
7
5
3
I_Z =200mA
10mA
10
30
50
70
V_Z (V)

Fig. 11.

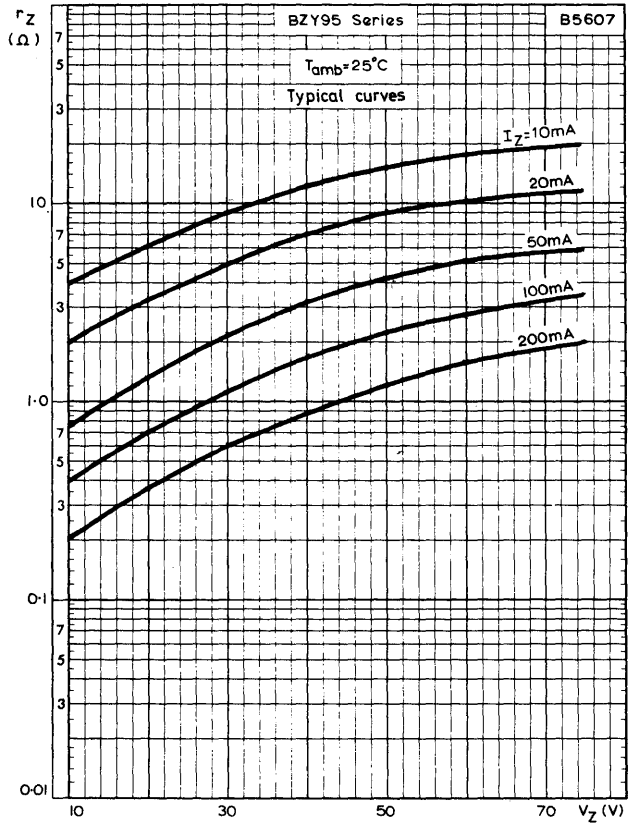

BZY95 Series
B5607
Tamb=25°C
Typical curves
IZ=10mA
20mA
50mA
100mA
200mA
rZ (Ω)
10
1·0
0·1
0·01
10
30
50
70
VZ (V)

Fig. 12.

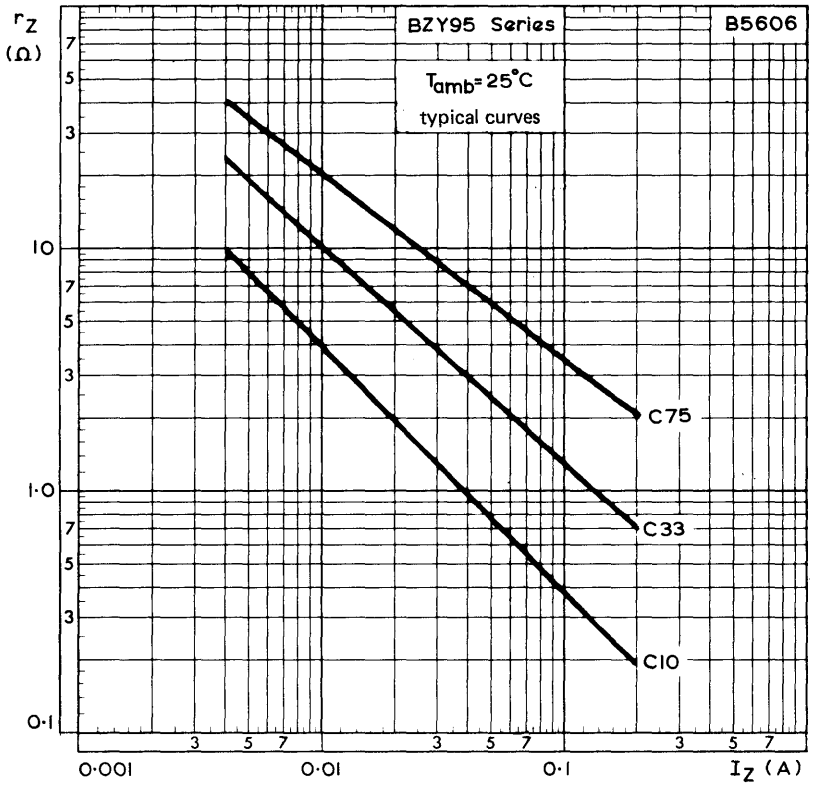

BZY95 Series
B5606
Tamb=25°C
typical curves
C75
C33
C10
rz (Ω)
10
1·0
0·1
0·001
0·01
0·1
IZ (A)

Fig. 13.

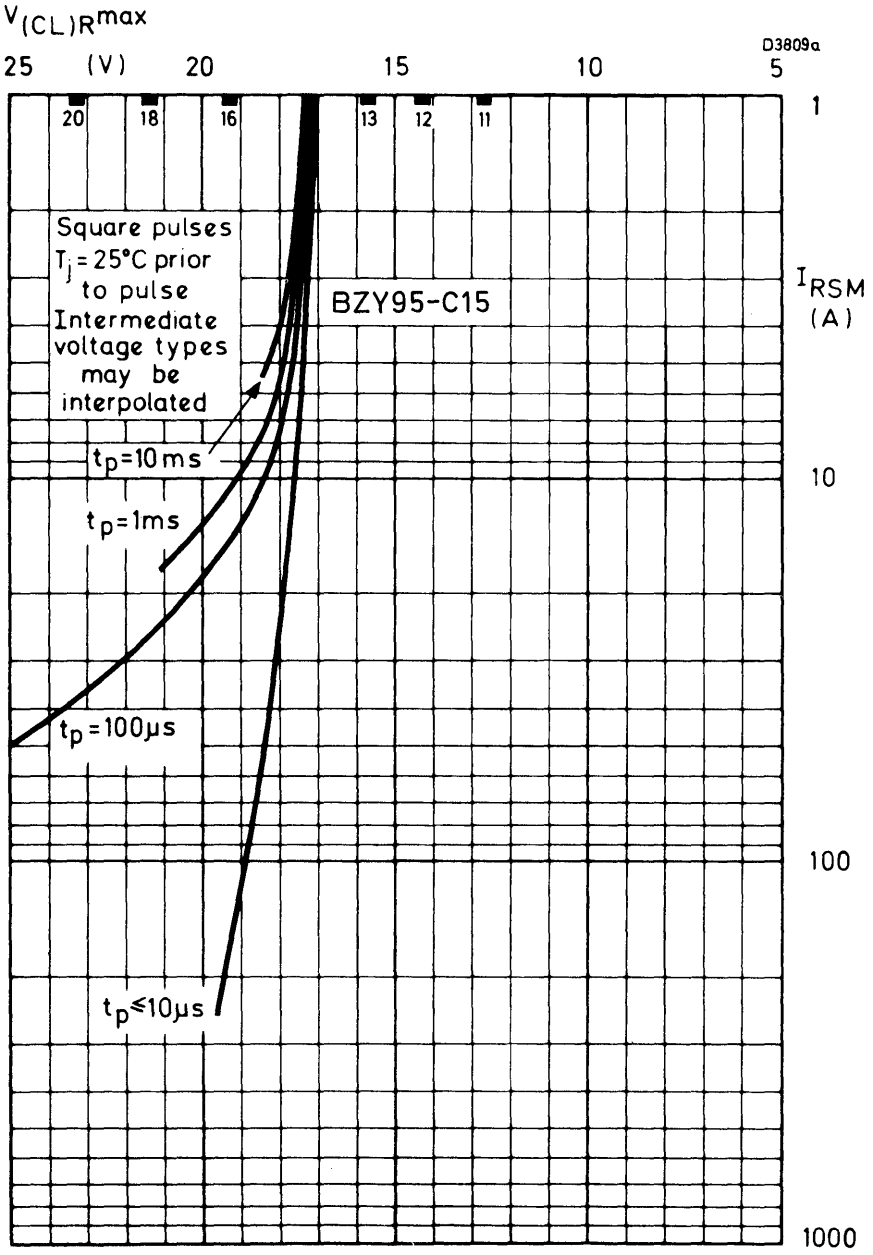

$V_{(CL)R}$max
25 (V) 20 15 10 5
D3809a
20 18 16 13 12 11
1
Square pulses
T_j = 25°C prior to pulse
Intermediate voltage types may be interpolated
BZY95-C15
I_{RSM} (A)
t_p=10ms
10
t_p=1ms
t_p=100µs
100
$t_p \leq$10µs
1000

Fig. 14.

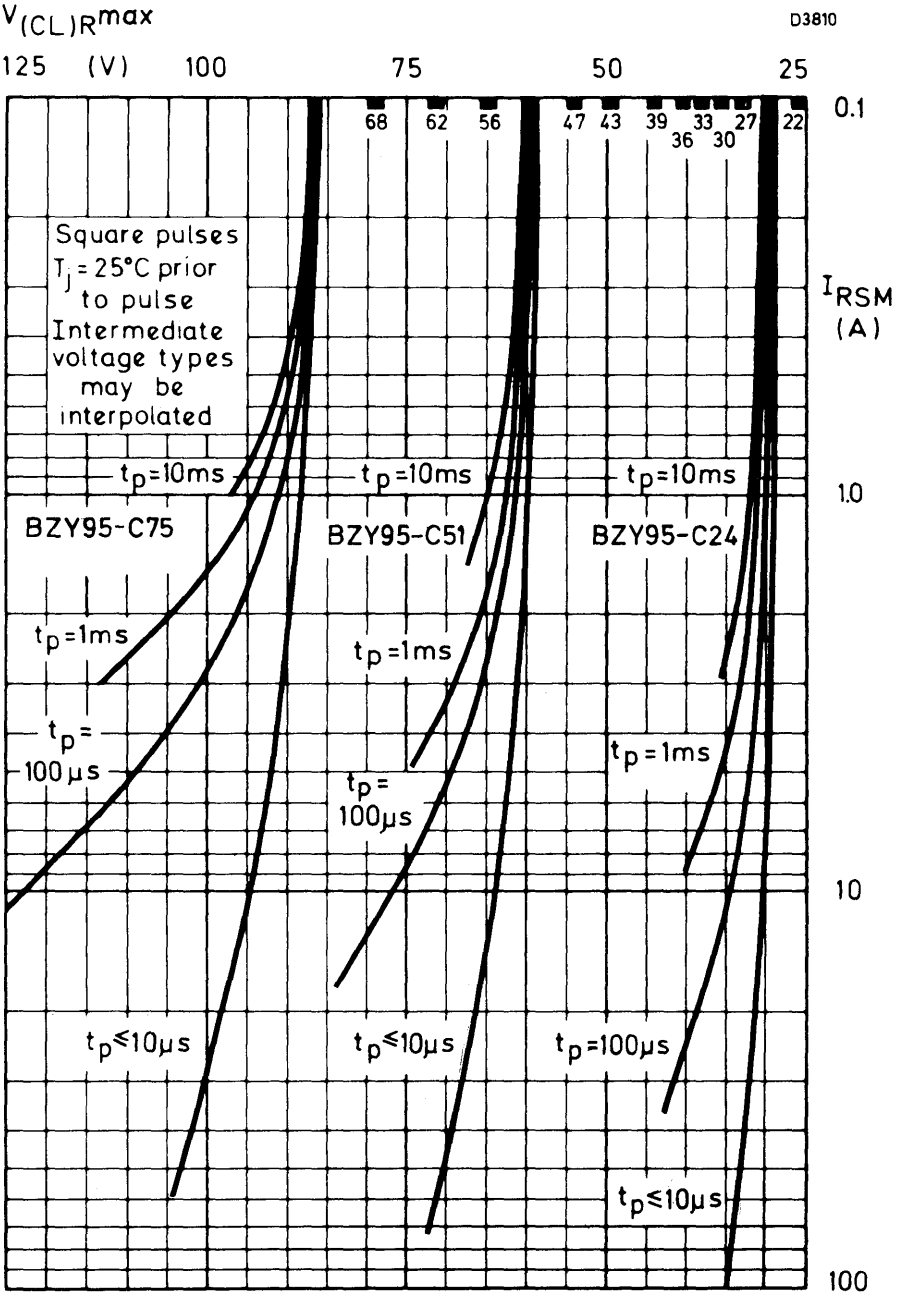

$V_{(CL)R}^{max}$
D3810
125 (V) 100 75 50 25
68 62 56 47 43 39 36 33 30 27 22
0.1
I_{RSM} (A)
1.0
10
100
Square pulses
T_j = 25°C prior to pulse
Intermediate voltage types may be interpolated
t_p=10ms
BZY95-C75
t_p=1ms
t_p= 100µs
t_p≤10µs
t_p=10ms
BZY95-C51
t_p=1ms
t_p= 100µs
t_p≤10µs
t_p=10ms
BZY95-C24
t_p=1ms
t_p=100µs
t_p≤10µs

Fig. 15.

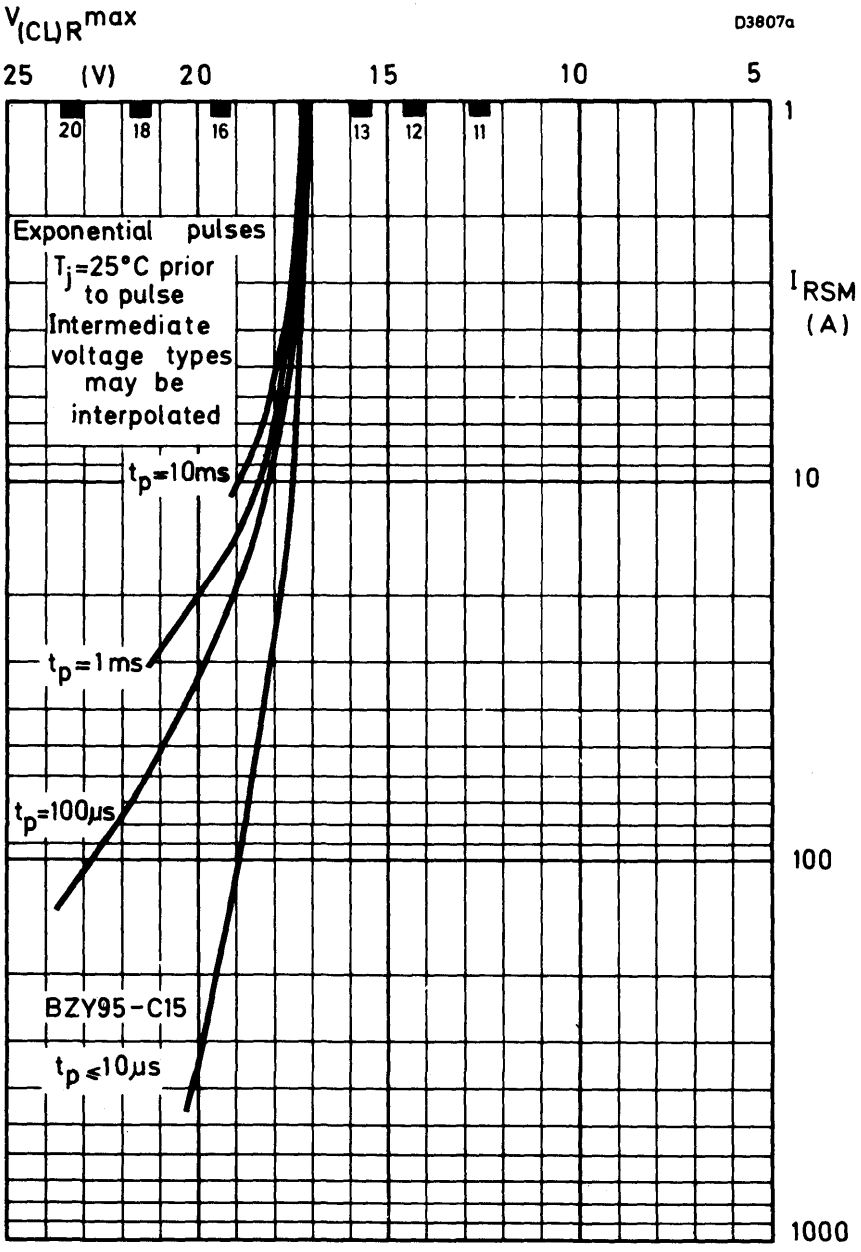

$V_{(CL)R}{}^{max}$
D3807a
25 (V) 20 15 10 5
20 18 16 13 12 11
1
I_{RSM} (A)
10
100
1000
Exponential pulses
T_j=25°C prior to pulse
Intermediate voltage types may be interpolated
t_p=10ms
t_p=1ms
t_p=100µs
BZY95-C15
$t_p \leq 10\mu s$

Fig. 16.

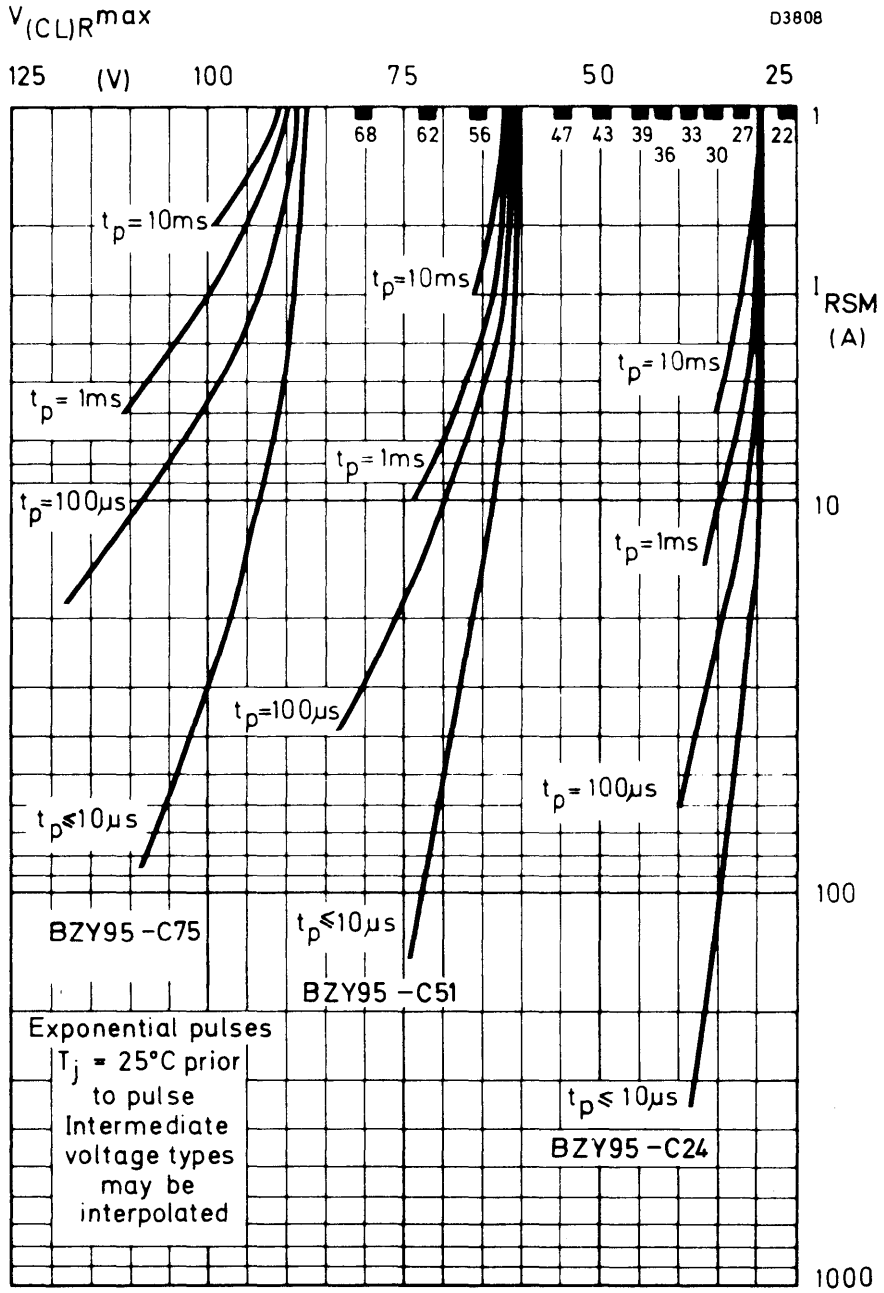

$V_{(CL)R}{}^{max}$
D3808
125 (V) 100 75 50 25
68 62 56 47 43 39 36 33 30 27 22
1
I_{RSM} (A)
10
100
1000
t_p= 10ms
t_p= 1ms
t_p=100µs
t_p≤10µs
BZY95 -C75
t_p=10ms
t_p= 1ms
t_p=100µs
t_p≤10µs
BZY95 -C51
t_p= 10ms
t_p= 1ms
t_p= 100µs
t_p≤ 10µs
BZY95 -C24
Exponential pulses
T_j = 25°C prior to pulse
Intermediate voltage types may be interpolated

Fig. 17.

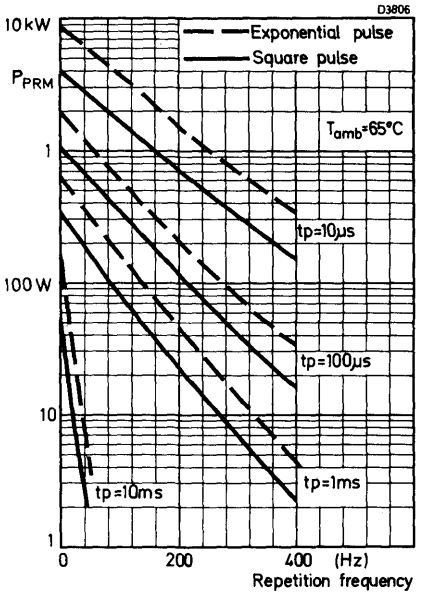


Fig. 18.

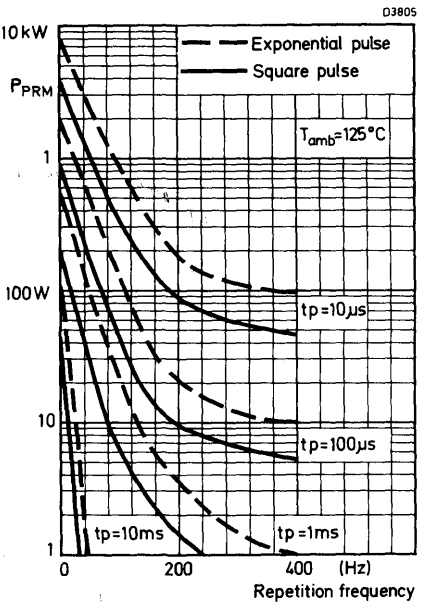


Fig. 19.

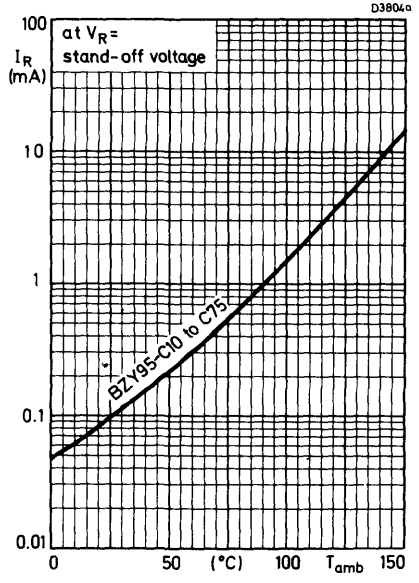


Fig. 20.

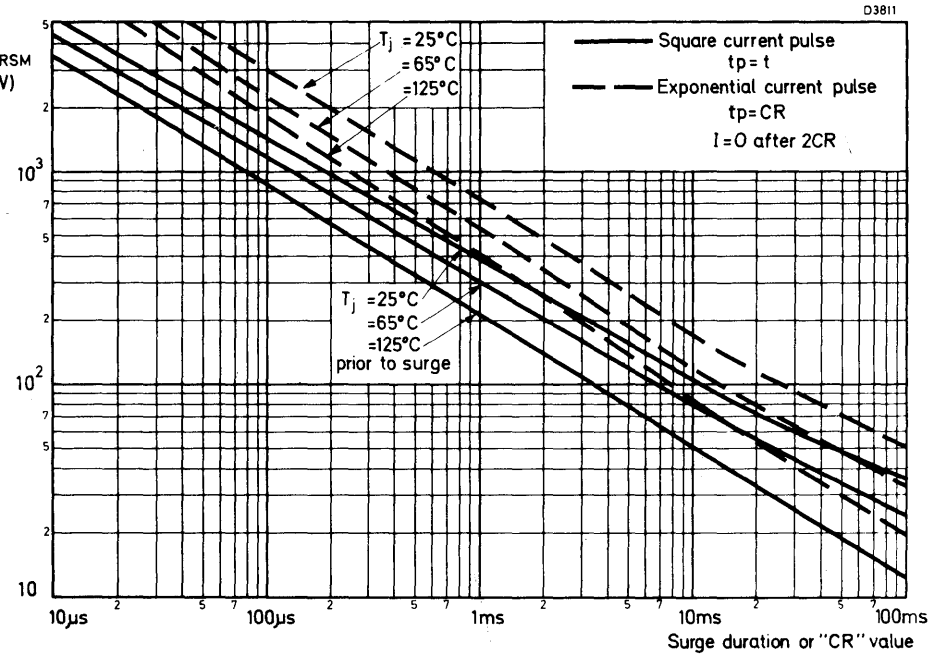

D3811
RSM
V)
10^3
10^2
10
T_j =25°C
=65°C
=125°C
Square current pulse
tp = t
Exponential current pulse
tp=CR
I=0 after 2CR
T_j =25°C
=65°C
=125°C
prior to surge
10µs
100µs
1ms
10ms
100ms
Surge duration or "CR" value

Fig. 21.