FAST TURN-OFF THYRISTORS

A range of fast turn-off thyristors in metal envelopes, intended for use in inverter applications. The series consists of reverse polarity types (anode to stud) identified by a suffix R: BTW33-800R to 1200R.

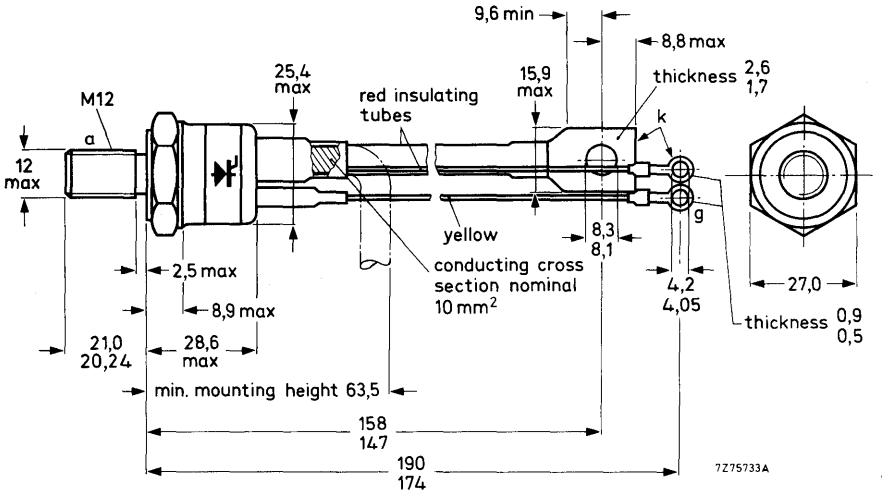
QUICK REFERENCE DATA

		BTW33-	800R	1000R	1200R	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	800	1000	1200	V
Average on-state current		$I_{T(AV)}$	max.		80	A
R.M.S. on-state current		$I_{T(RMS)}$	max.		110	A
Non-repetitive peak on-state current		I_{TSM}	max.		1500	A
Circuit-commutated turn-off time		t_q	<		25	μs

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-94; with metric M12 stud (ϕ 12 mm)



Net mass: 108 g
Diameter of clearance hole: max. 13,0 mm
Torque on nut: min. 9 Nm (90 kg cm)
max. 17,5 Nm (175 kg cm)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats;
M12: 19 mm

RATINGS

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

Anode to cathode

		BTW33-800R	1000R	1200R	
Non-repetitive peak voltages ($t \leqslant 10$ ms)	V_{DSM}**/V_{RSM}	max. 800	1000	1200	V
Repetitive peak voltages	V_{DRM}/V_{RRM}	max. 800	1000	1200	V▲
Crest working off-state voltage square-wave; $\delta = 0,5$	V_{DWM}	max. 600	800	1000	V *

Average on-state current assuming zero switching losses (averaged over any 20 ms period)			
square-wave; $\delta = 0,5$; up to $T_{mb} = 70$ °C	$I_{T(AV)}$	max.	80 A
square-wave; $\delta = 0,5$; at $T_{mb} = 85$ °C	$I_{T(AV)}$	max.	65 A
sinusoidal; at $T_{mb} = 85$ °C	$I_{T(AV)}$	max.	60 A
R.M.S. on-state current	$I_{T(RMS)}$	max.	110 A
Repetitive peak on-state current	I_{TRM}	max.	750 A
Non-repetitive peak on-state current $T_j = 125$ °C prior to surge			
$t = 10$ ms; half sine-wave (see Fig. 8)	I_{TSM}	max.	1500 A
$t = 5$ ms; square pulse (see Fig. 7)	I_{TSM}	max.	1500 A
I^2t for fusing ($t = 10$ ms)	I^2t	max.	11 250 A^2s
Rate of rise of on-state current after triggering with $I_G = 750$ mA to $I_T = 200$ A; $dI_G/dt = 1$ A/µs	dI_T/dt	max.	100 A/µs

Gate to cathode

Reverse peak voltage	V_{RGM}	max.	10 V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	2 W
Peak power dissipation	P_{GM}	max.	10 W

Temperatures

	T_{stg}	−55 to + 125	°C
Storage temperature	T_{stg}	−55 to + 125	°C
Junction temperature	T_j	max. 125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	= 0,3	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	= 0,1	°C/W
Transient thermal impedance ($t = 1$ ms)	$Z_{th\ j\text{-}mb}$	= 0,015	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a} < 0,75$ °C/W (d.c. blocking) or $< 1,5$ °C/W (square-wave; $\delta = 0,5$). For smaller heatsinks $T_{j\ max}$ should be derated. For square-wave see Fig. 6.

** Although not recommended, higher off-state voltages may be applied without damage, but the thyristor may switch into the on-state. The rate of rise of on-state current should not exceed 20 A/µs.

▲ Thermal stability at higher voltage ratings is dependent on duty factor. See Figs 19 and 20.

CHARACTERISTICS

Anode to cathode

On-state voltage I_T = 200 A; T_j = 25 °C	V_T	<	3 V *
Rate of rise of off-state voltage that will not trigger any device; exponential method; V_D = 2/3 V_{DRMmax}; T_j = 125 °C	dV_D/dt	<	200 V/μs
Off-state current V_D = V_{DWMmax}; T_j = 125 °C	I_D	<	25 mA
Holding current; T_j = 25 °C	I_H	<	200 mA
Latching current; T_j = 25 °C	I_L	<	400 mA

Gate to cathode

Voltage that will trigger all devices V_D = 6 V; T_j = 25 °C	V_{GT}	>	2,5 V
Voltage that will not trigger any device V_D = V_{DRMmax}; T_j = 125 °C	V_{GD}	<	0,2 V
Current that will trigger all devices V_D = 6 V; T_j = 25 °C	I_{GT}	>	150 mA

Switching characteristics

Gate-controlled turn-on time (t_{gt} = t_d + t_r) when switched from V_D = V_{DWMmax} to I_T = 200 A; I_{GT} = 200 mA; dI_G/dt = 1 A/μs; T_j = 25 °C	t_d	<	2 μs
	t_r	<	2 μs

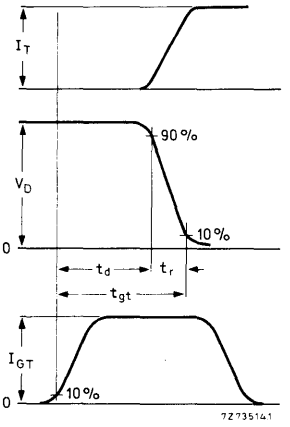


Fig. 2 Gate-controlled turn-on time definitions.

* Measured under pulse conditions to avoid excessive dissipation.

CHARACTERISTICS (continued)

Circuit-commutated turn-off time when switched from I_T = 50 A to $V_R \geqslant 50$ V with $-dI_T/dt$ = 50 A/μs; dV_D/dt = 25 V/μs; T_j = 125 °C

t_q < 25 μs

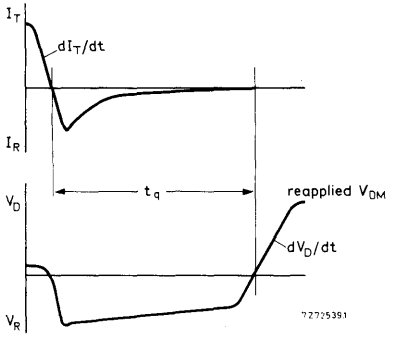


Fig. 3 Circuit-commutated turn-off time definitions.

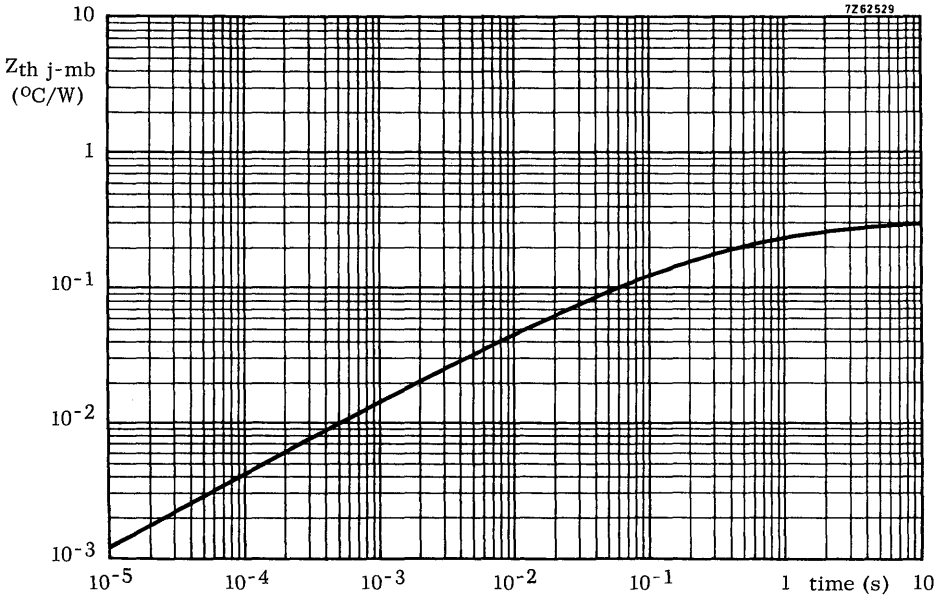


Fig. 4.

P = dissipation excluding switching losses

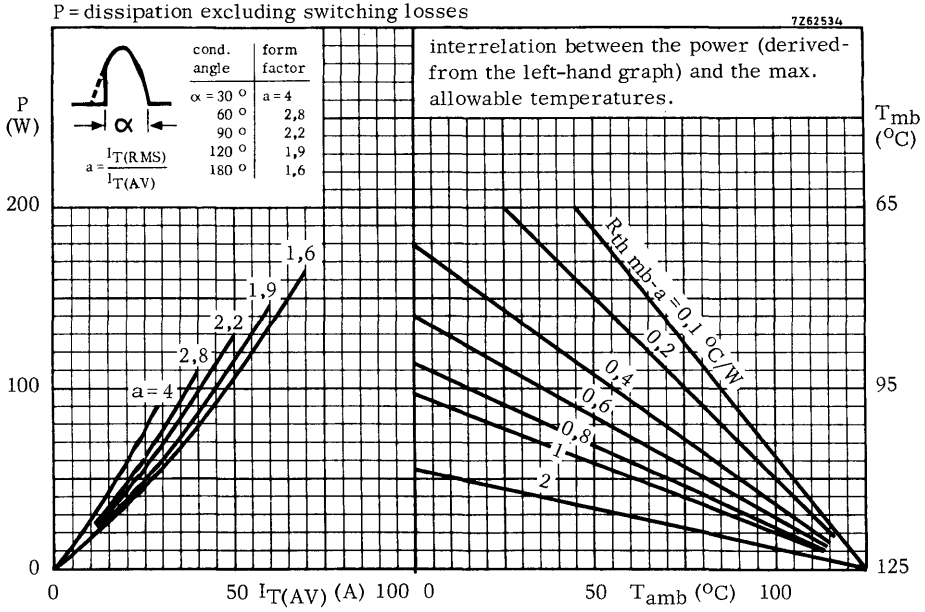
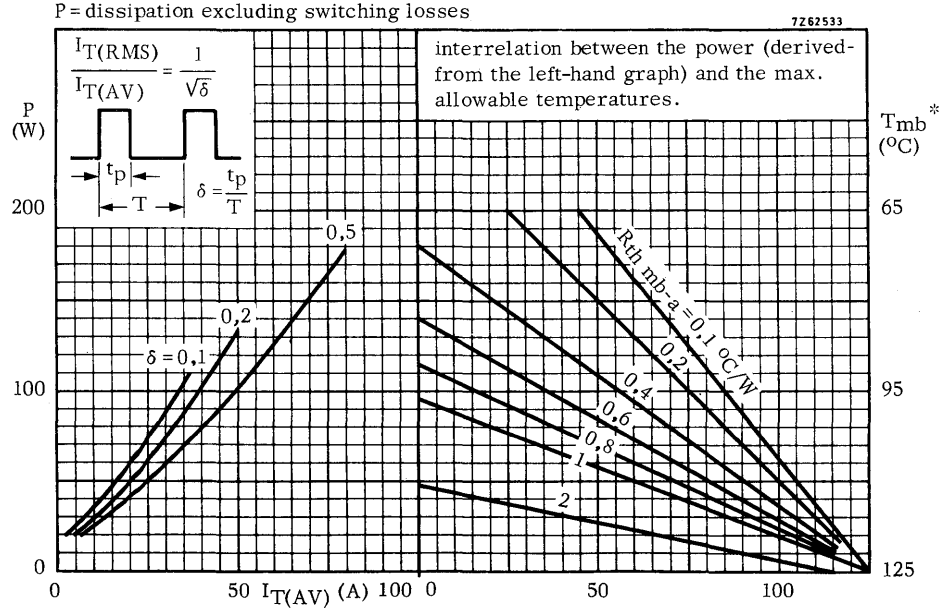


Fig. 5.

P = dissipation excluding switching losses



* T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb\text{-}a} \leq 1{,}0$ °C/W.

Fig. 6.

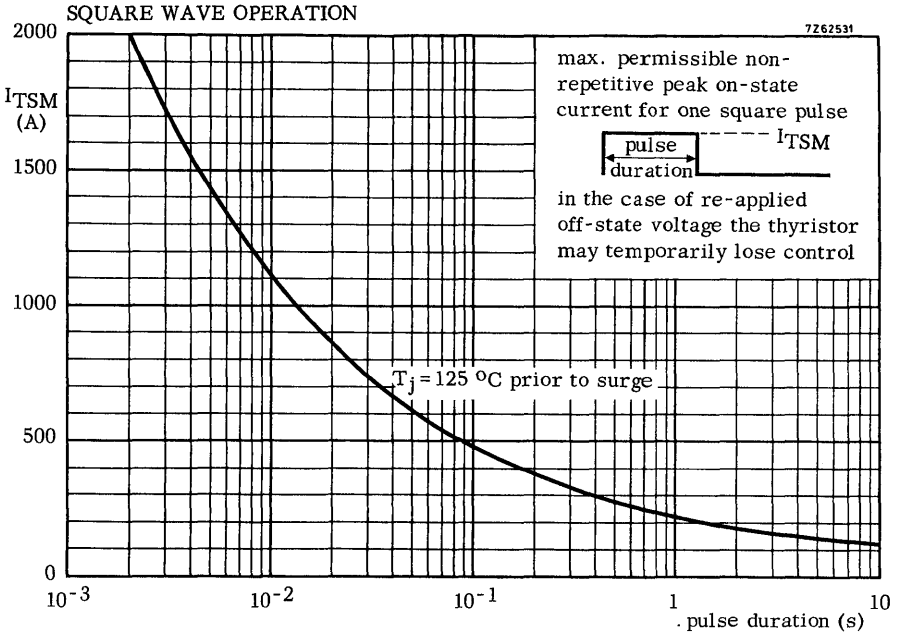

SQUARE WAVE OPERATION
7Z62531
2000
I_{TSM} (A)
1500
1000
500
0
10^{-3}
10^{-2}
10^{-1}
1
10
. pulse duration (s)
max. permissible non-repetitive peak on-state current for one square pulse
pulse duration
I_{TSM}
in the case of re-applied off-state voltage the thyristor may temporarily lose control
T_j = 125 °C prior to surge

Fig. 7.

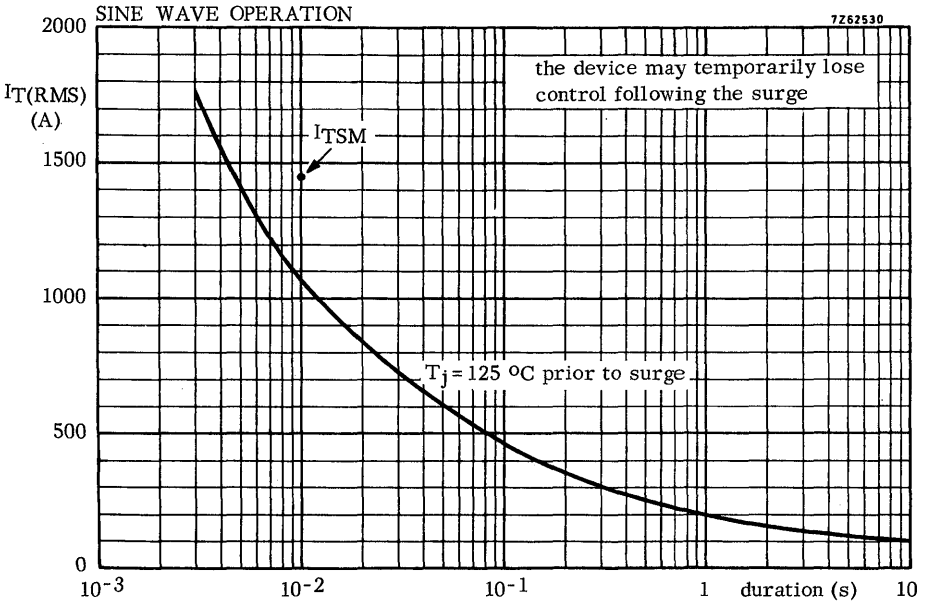

SINE WAVE OPERATION
7Z62530
2000
$I_{T(RMS)}$ (A)
1500
1000
500
0
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10
the device may temporarily lose control following the surge
I_{TSM}
T_j = 125 °C prior to surge

Fig. 8.

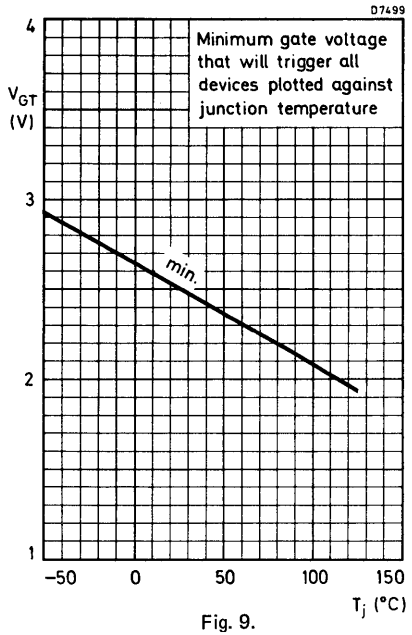


Fig. 9.

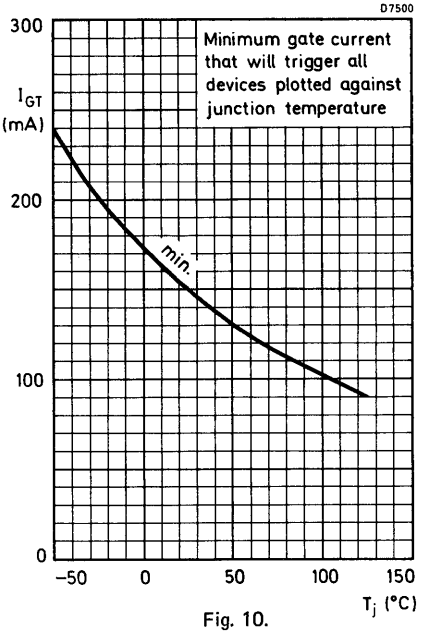


Fig. 10.

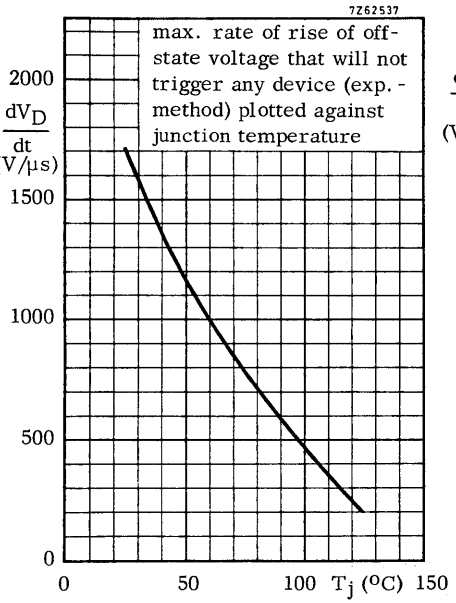


Fig. 11.

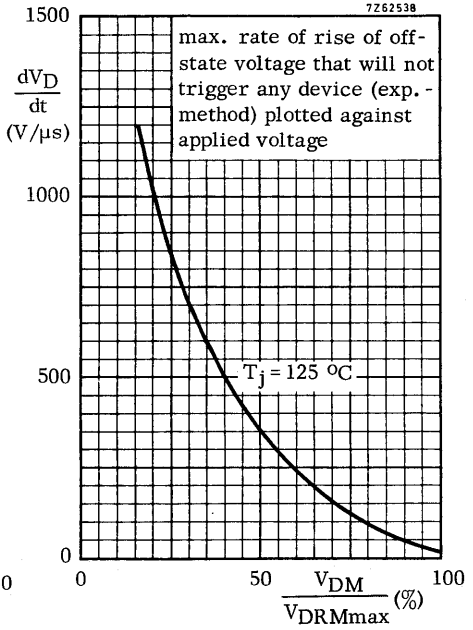


Fig. 12.

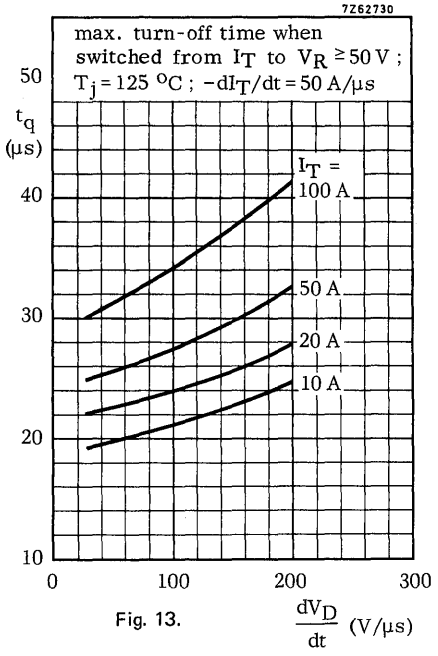


Fig. 13.

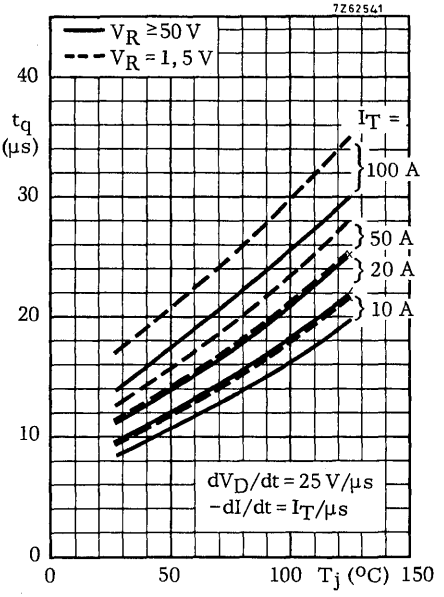


Fig. 14.

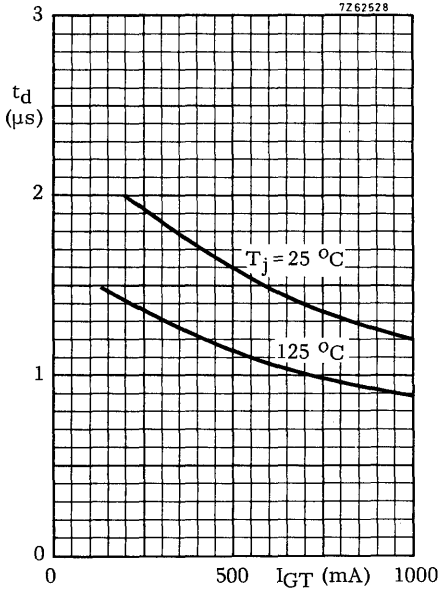


Fig. 15.

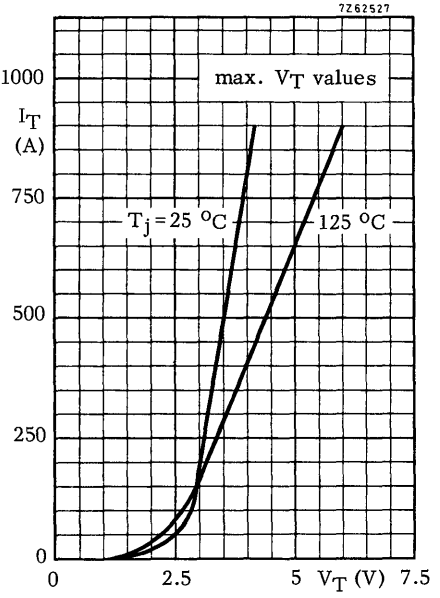


Fig. 16.

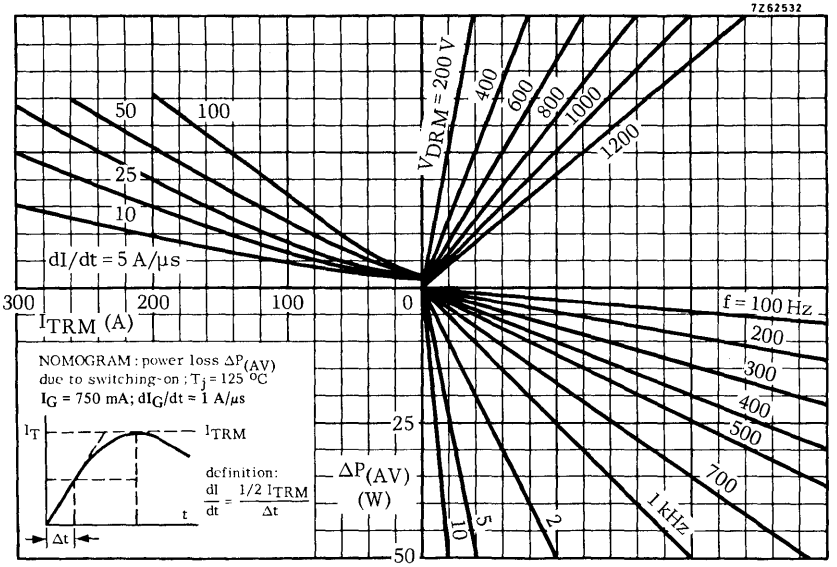

7Z62532
50
100
25
10
dI/dt = 5 A/μs
300
200
100
0
ITRM (A)
NOMOGRAM: power loss ΔP(AV)
due to switching-on; Tj = 125 °C
IG = 750 mA; dIG/dt = 1 A/μs
IT
ITRM
t
Δt
definition:
dI/dt = 1/2 ITRM / Δt
25
ΔP(AV)
(W)
50
VDRM = 200 V
400
600
800
1000
1200
f = 100 Hz
200
300
400
500
700
1 kHz
2
5
10

Fig. 17.

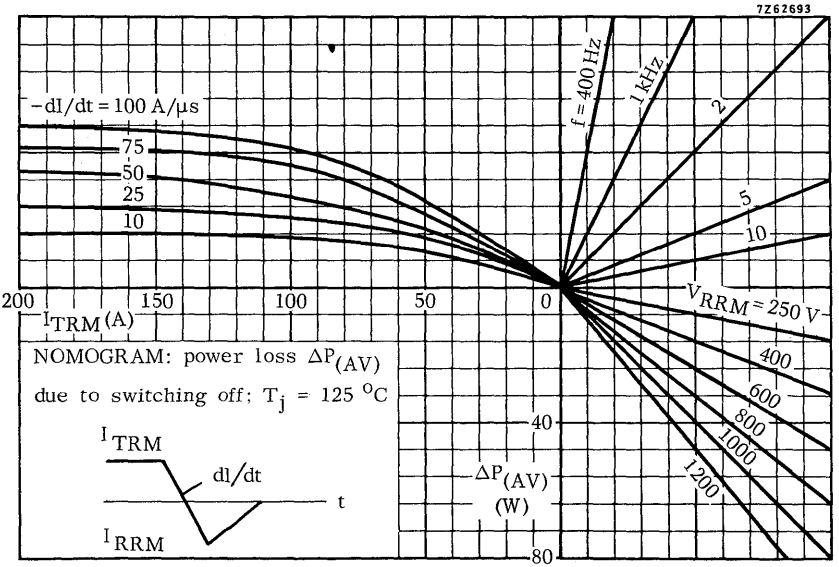

7Z62693
-dI/dt = 100 A/μs
75
50
25
10
200
150
100
50
0
ITRM (A)
NOMOGRAM: power loss ΔP(AV)
due to switching off; Tj = 125 °C
ITRM
dI/dt
t
IRRM
40
ΔP(AV)
(W)
80
f = 400 Hz
1 kHz
2
5
10
VRRM = 250 V
400
600
800
1000
1200

Fig. 18.

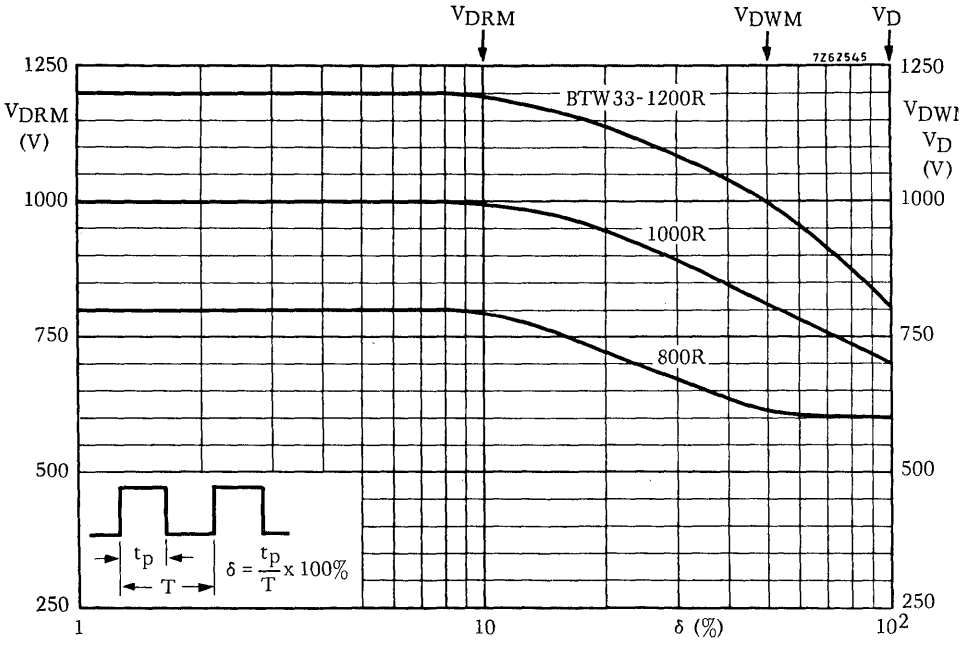

VDRM
VDWM
VD
7Z62545
1250
VDRM (V)
1000
750
500
250
BTW33-1200R
1000R
800R
tp
T
δ = tp/T x 100%
1
10
δ (%)
10²
VDWM
VD (V)

Fig. 19.

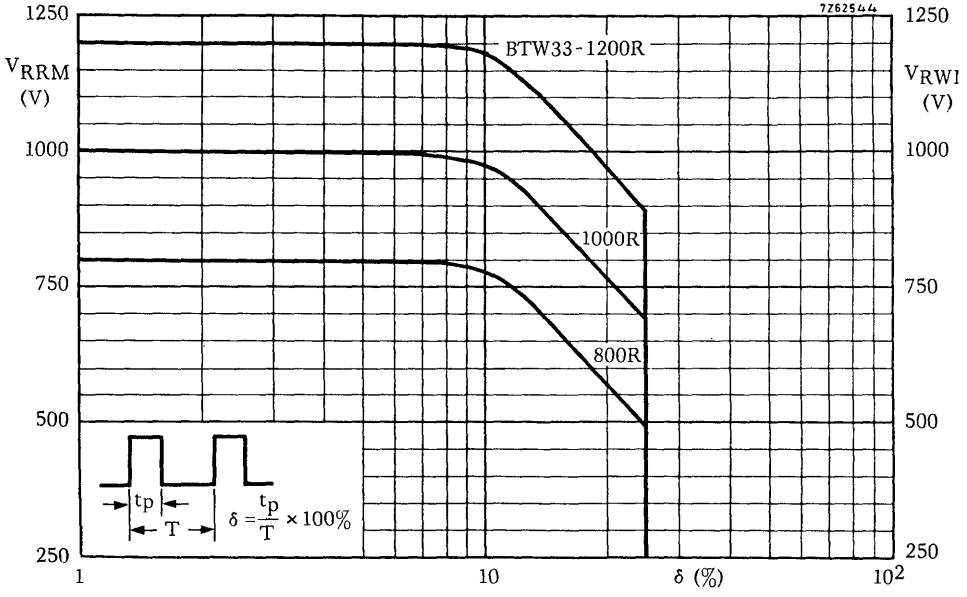

7Z62544
1250
VRRM (V)
1000
750
500
250
BTW33-1200R
1000R
800R
tp
T
δ = tp/T x 100%
1
10
δ (%)
10²
VRWM (V)

Fig. 20.