FAST GATE TURN-OFF THYRISTORS

Thyristors in TO-220AB envelopes capable of being turned both on and off via the gate. They are suitable for use in high-frequency inverters, resonant power supplies, horizontal deflection systems etc. The devices have no reverse blocking capability. For reverse blocking operation use with a series diode, for reverse conducting operation use with an anti parallel diode.

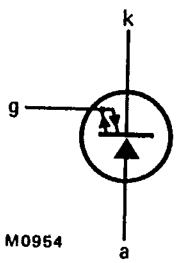
QUICK REFERENCE DATA

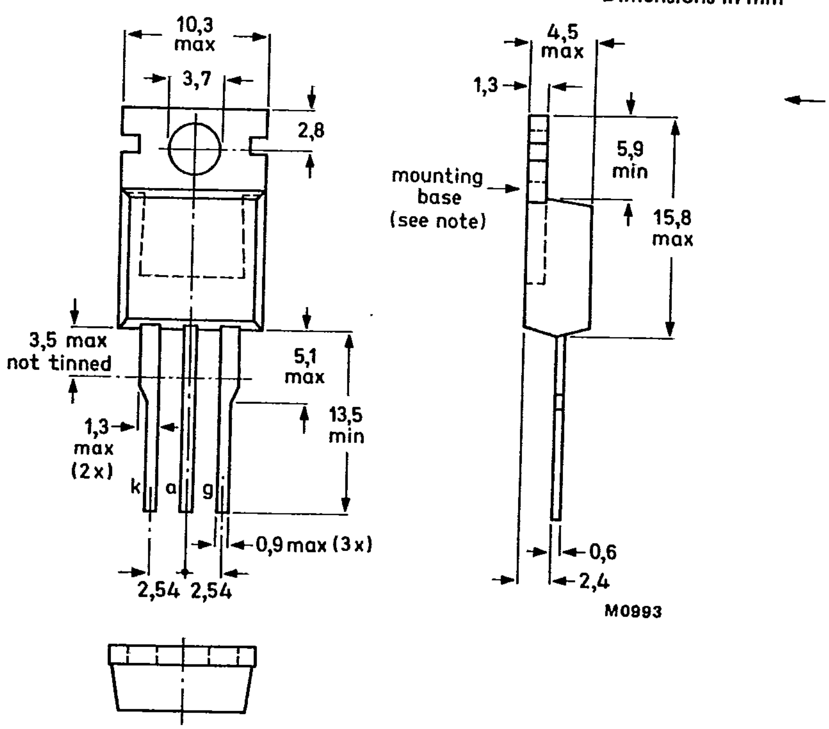
			BT157–1300R	1500R	
Repetitive peak off-state voltage	V_{DRM}	max.	1300	1500	V
Non-repetitive peak on-state current	I_{TSM}	max.	20		A
Controllable anode current	I_{TCRM}	max.	12		A
Average on-state current	$I_{T(AV)}$	max.	3.2		A
Fall time	t_f	max.	200		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AB





Net mass: 2 g

Note: The exposed metal mounting base is directly connected to the anode.

Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

			BT157–1300R	1500R	
Anode to cathode					
Transient off-state voltage	V_{DSM}	max.	1500	1650	V*
Repetitive peak off-state voltage	V_{DRM}	max.	1300	1500	V*
Working off-state voltage	V_{DW}	max.	1200	1300	V*
Continuous off-state voltage	V_D	max.	750	800	V*
Average on-state current (averaged over any 20 ms period) up to T_{mb} = 80 °C	$I_{T(AV)}$	max.	3.2		A
Controllable anode current	I_{TCRM}	max.	12		A
Non-repetitive peak on-state current t = 10 ms; half-sinewave; T_j = 120 °C prior to surge	I_{TSM}	max.	20		A
I^2t for fusing; t = 10 ms	I^2t	max.	2		A^2s
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	47.5		W
Gate to cathode					
Repetitive peak on-state current T_j = 120 °C prior to surge. gate-cathode forward; t = 1 ms; half-sinewave	I_{GFM}	max.	25		A
gate-cathode reverse; t = 20 µs	I_{GRM}	max.	15		A
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	2.5		W
Temperatures					
Storage temperature	T_{stg}		−40 to +150		°C
Operating junction temperature	T_j	max.	120		°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.0	K/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
with 56367 alumina insulator and heatsink compound (clip-mounted)	$R_{th\ mb\text{-}h}$	=	0.8	K/W
From junction to ambient in free air, mounted on a printed circuit board	$R_{th\ j\text{-}a}$	=	60	K/W

* Measured with gate-cathode connected together.

CHARACTERISTICS

Anode to cathode

On-state voltage I_T = 2.5 A; I_G = 0.2 A; T_j = 120 °C	V_T	<	3.4	V*
Rate of rise of off-state voltage that will not trigger any off-state device; exponential method V_D = 2/3 V_{Dmax}; V_{GR} = 5 V; T_j = 120 °C	dV_D/dt	<	10	kV/µs
Rate of rise of off-state voltage that will not trigger any device following conduction; linear method; I_T = 1.8 A; V_D = V_{DRMmax}; V_{GR} = 10 V; T_j = 120 °C	dV_D/dt	<	1.5	kV/µs
Off-state current V_D = V_{Dmax}; T_j = 120 °C	I_D	<	2.0	mA
Latching current; T_j = 25 °C	I_L	typ.	0.75	A**

Gate to cathode

Voltage that will trigger all devices V_D = 12 V; T_j = 25 °C	V_{GT}	>	1.5	V
Current that will trigger all devices V_D = 12 V; T_j = 25 °C	I_{GT}	>	200	mA
Minimum reverse breakdown voltage I_{GRM} = 1.0 mA	$V_{(BR)GR}$	>	10	V

Switching characteristics (resistive load)

Turn-on when switched to I_T = 2.5 A from V_D = 250 V with I_{GF} = 0.4 A; T_j = 25 °C delay time	t_d	<	0.25	µs
rise time	t_r	<	1.0	µs

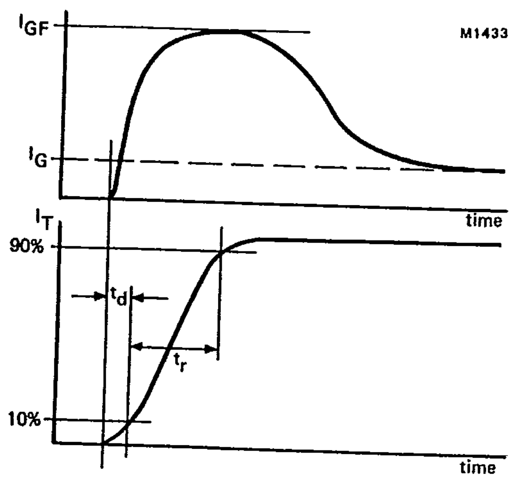


Fig.2 Waveforms

* Measured under pulse conditions to avoid excessive dissipation.
** Below latching level the device behaves like a transistor with a gain dependent on current.

Switching characteristics (inductive load)

Turn-off when switched from I_T = 2.5 A to V_D = V_{DRM} max.
V_{GR} = 10 V; $L_G \leqslant$ 1.5 μH; $L_S \leqslant$ 0.25 μH, T_j = 25 °C

storage time	t_s	<	0.5	μs
fall time	t_f	<	0.20	μs
peak reverse gate current	I_{GR}	<	2.8	A

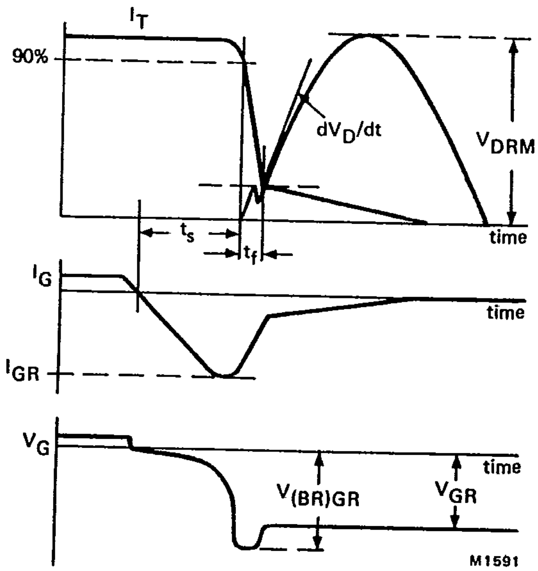


Fig.3 Waveforms

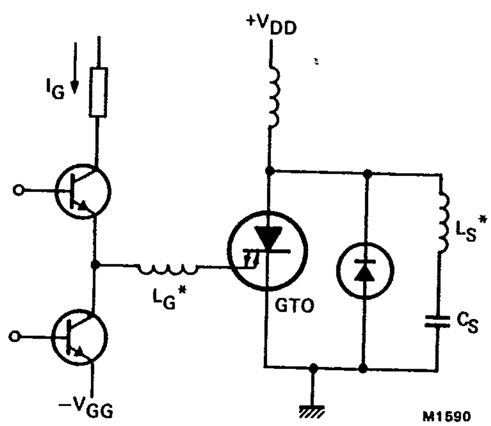


Fig.4 Inductive load test circuit

* Indicates stray series inductance only.

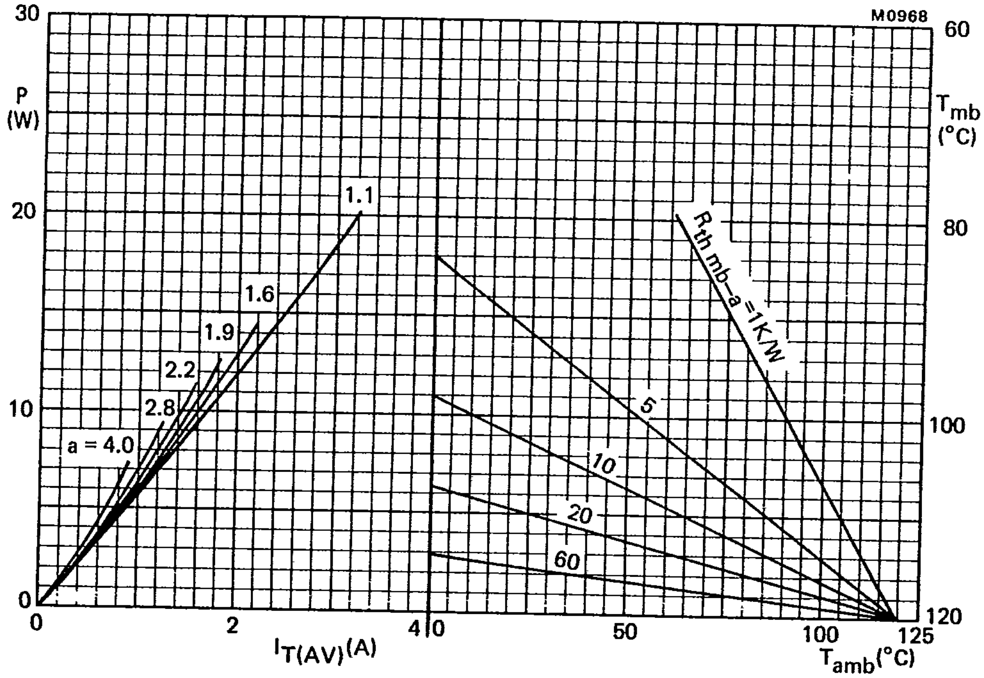


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

$$a = \text{form factor} = \frac{I_{T(RMS)}}{I_{T(AV)}}$$

P = Power excluding switching losses

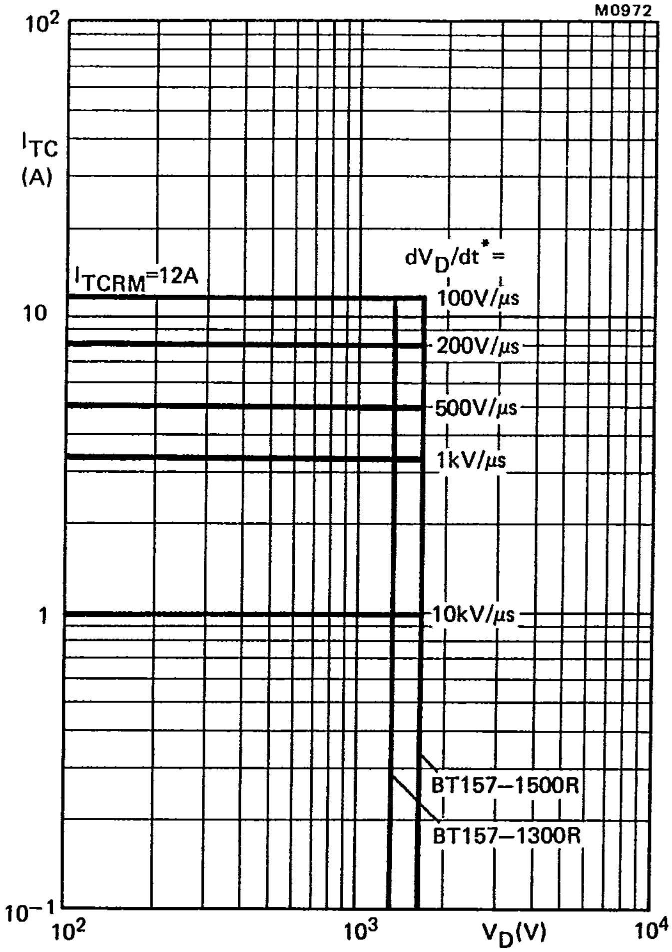


Fig.6 Anode current which can be turned off versus anode voltage; inductive load, V_{GR} = 10 V; $L_G \leqslant 1.5\ \mu H$; $L_S \leqslant 0.25\ \mu H$; T_j = 85 °C
$^*dV_D/dt$ is calculated from I_T/C_S.

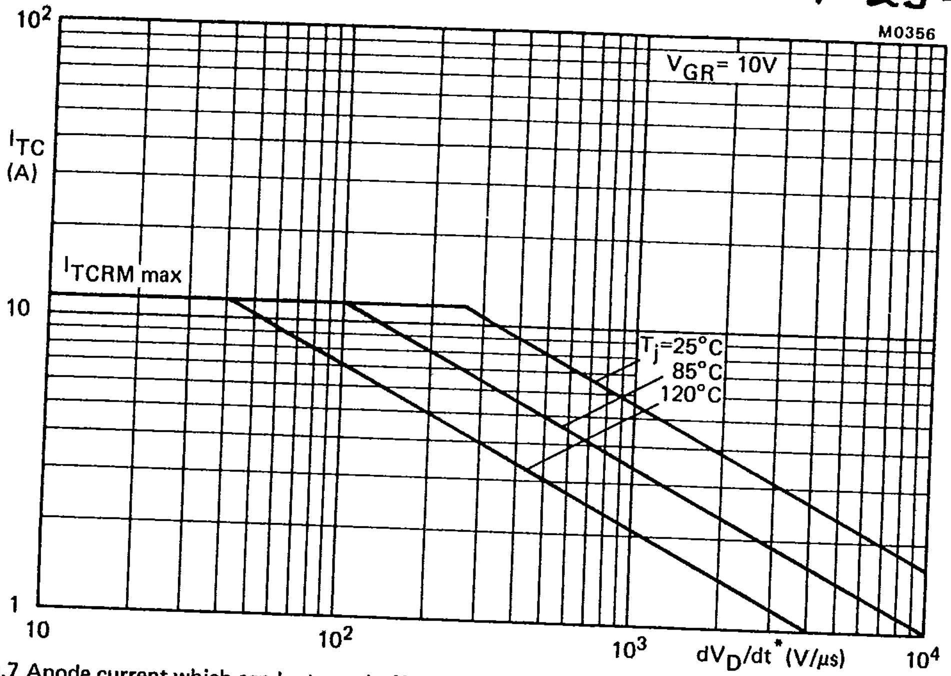


Fig.7 Anode current which can be turned off versus applied dV_D/dt^*; inductive load; V_{GR} = 10 V; $L_G \leq 1.5\ \mu H$; $L_S \leq 0.25\ \mu H$; $^*dV_D/dt$ is calculated from I_T/C_S.

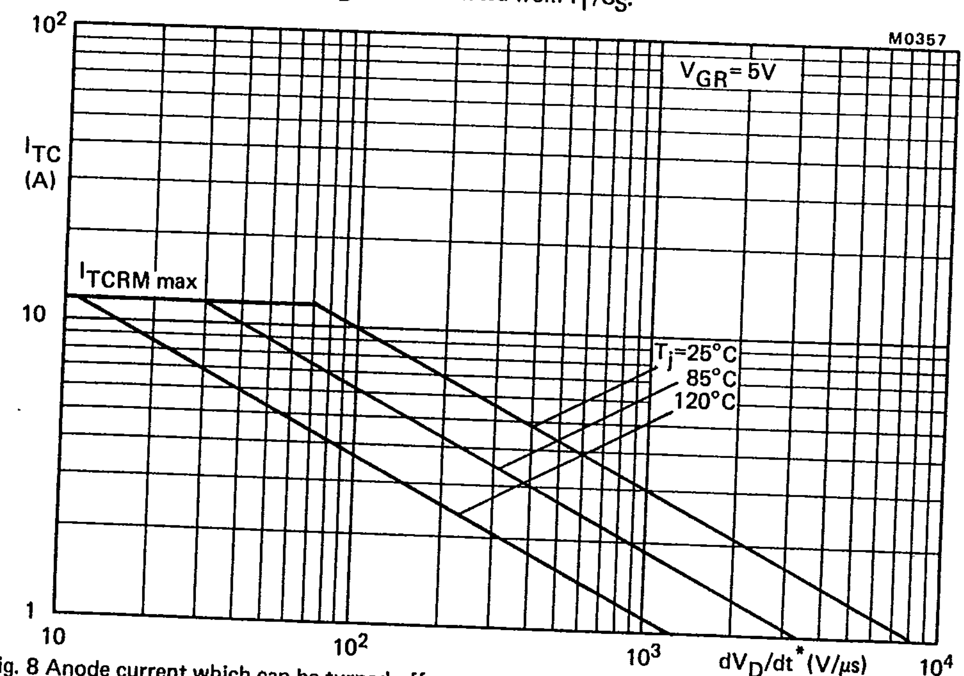


Fig. 8 Anode current which can be turned off versus applied dV_D/dt; inductive load; V_{GR} = 5 V. $L_G \leq 1.5\ \mu H$; $L_S \leq 0.25\ \mu H$; $^*dV_D/dt$ is calculated from I_T/C_S.

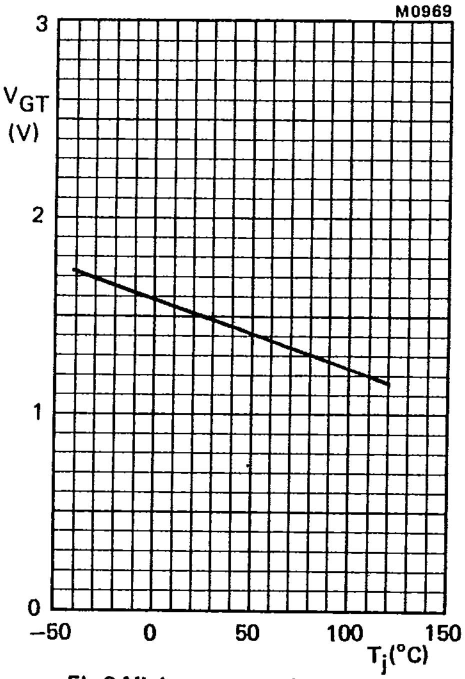


Fig.9 Minimum gate voltage that will trigger all devices as a function of junction temperature; V_D = 12 V.

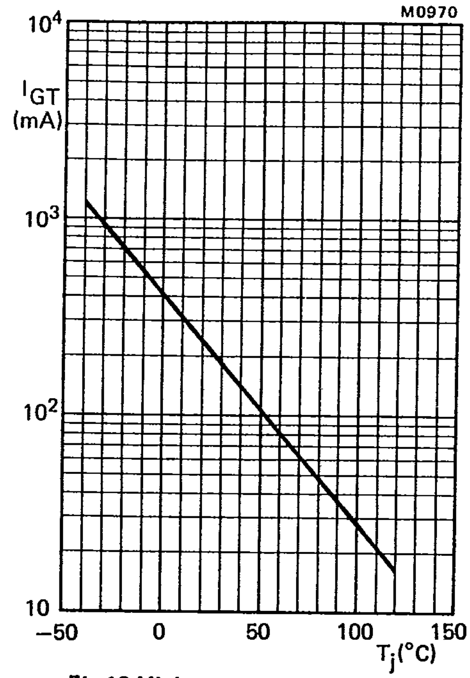


Fig.10 Minimum gate current that will trigger all devices as a function of junction temperature; V_D = 12 V.

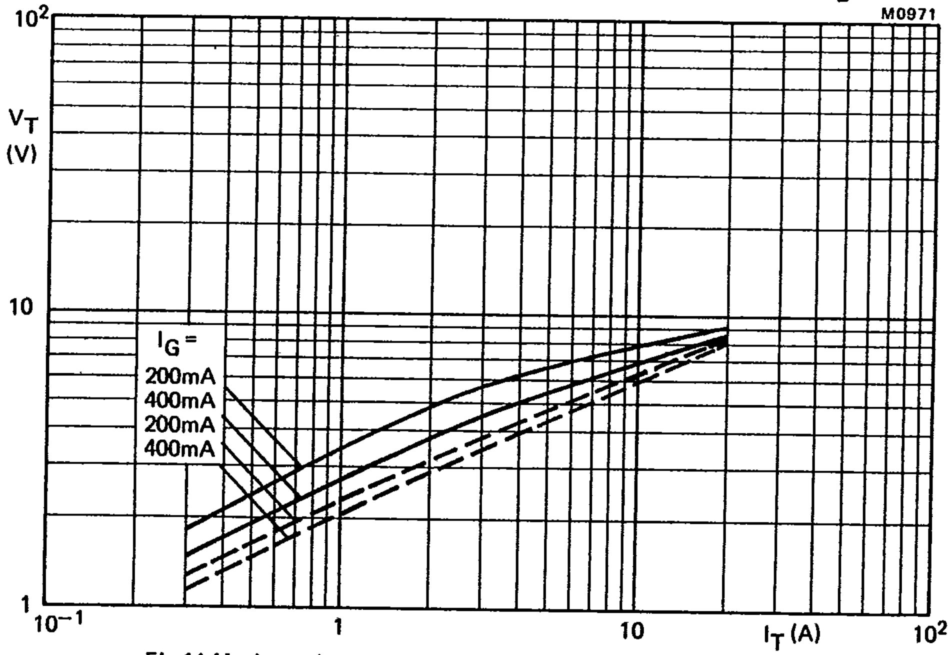


Fig.11 Maximum V_T versus I_T; —— T_j = 25 °C; – – · – T_j = 120 °C.

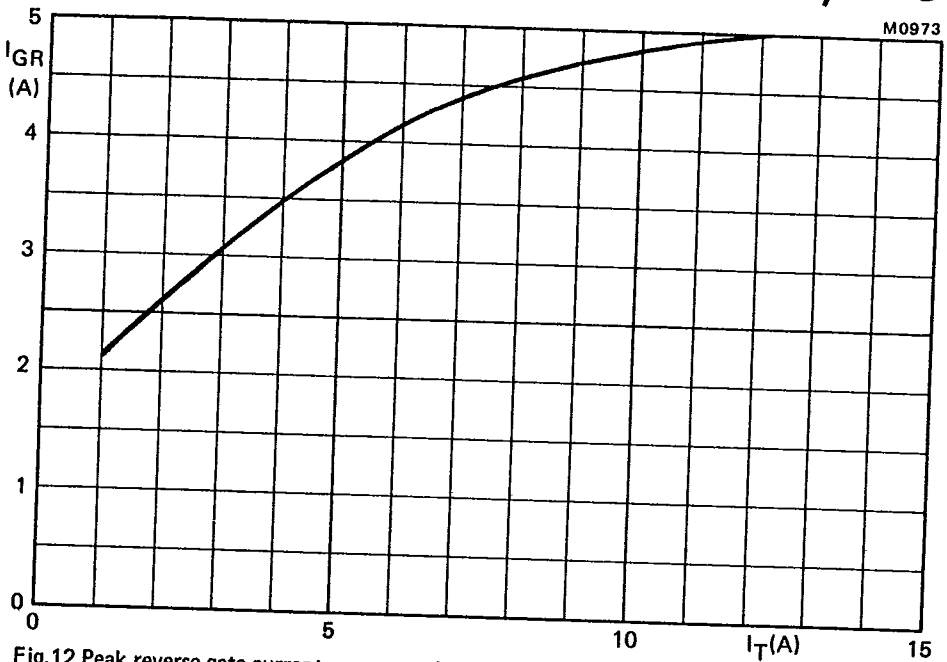


Fig.12 Peak reverse gate current versus anode current at turn-off; inductive load; V_{GR} = 10 V; I_G = 0.2 A; L_G = 0.8 μH; T_j = 120 °C; maximum values.

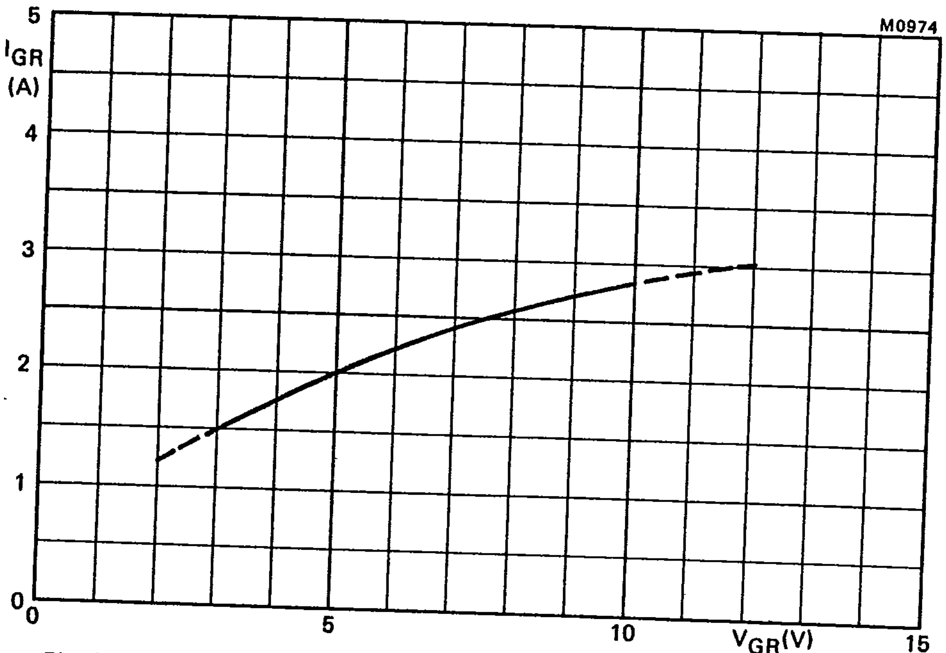


Fig.13 Peak reverse gate current versus applied gate voltage; inductive load; I_T = 2.5 A; I_G = 0.2 A; L_G = 0.8 μH; T_j = 120 °C; maximum values.

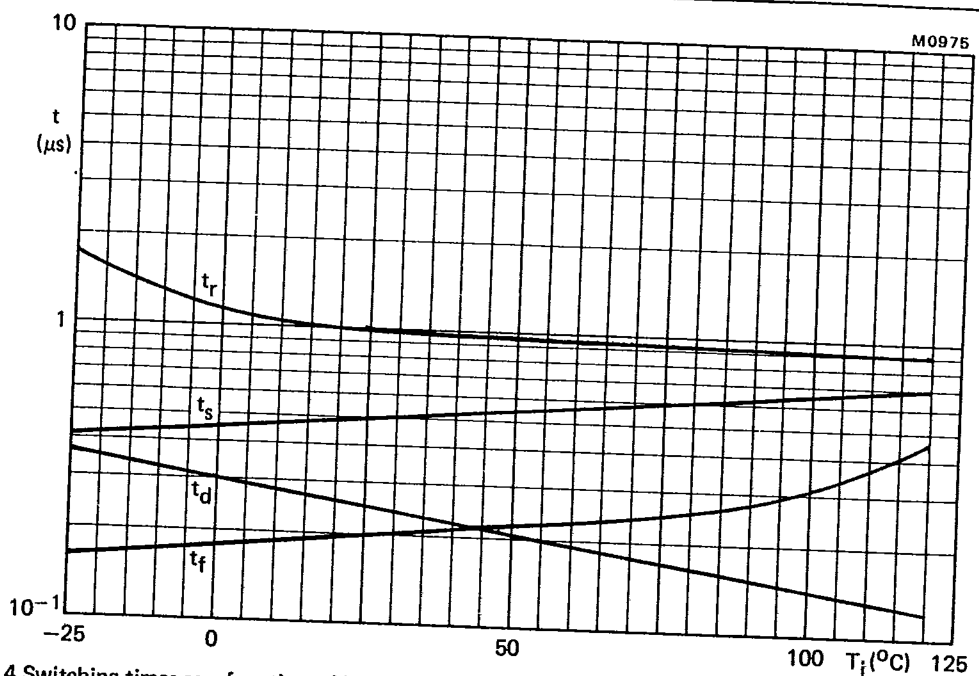


Fig.14 Switching times as a function of junction temperature; $V_D \geq 250$ V; $I_T = 2.5$ A; $I_{GF} = 0.4$ A; $I_G = 0.2$ A; $V_{GR} = 10$ V; $L_G = 0.8$ μH; maximum values.

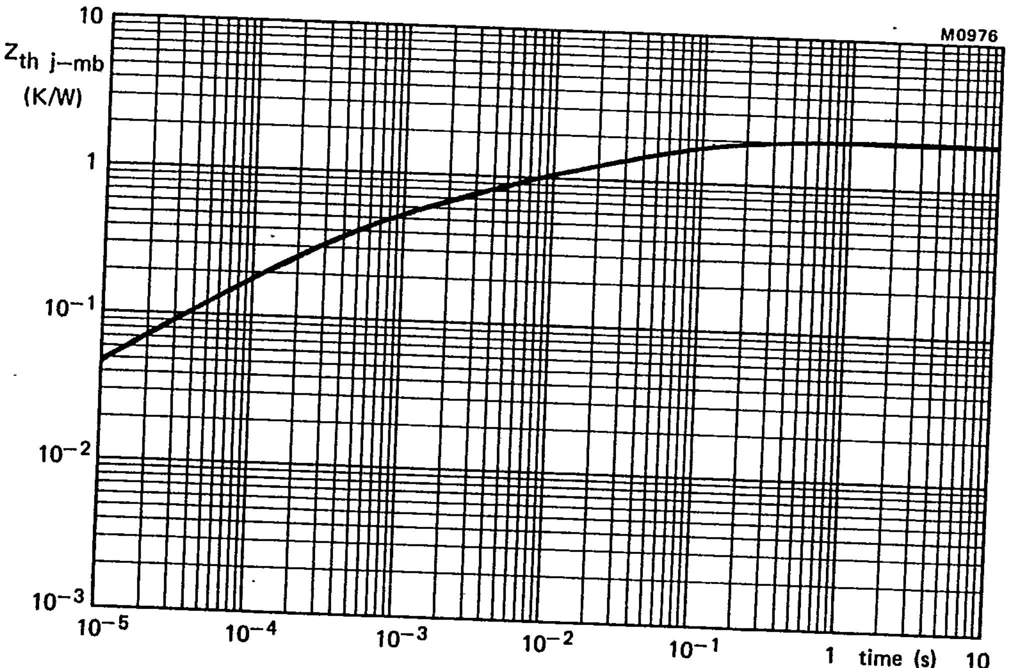


Fig.15 Transient thermal impedance.

T-25-13

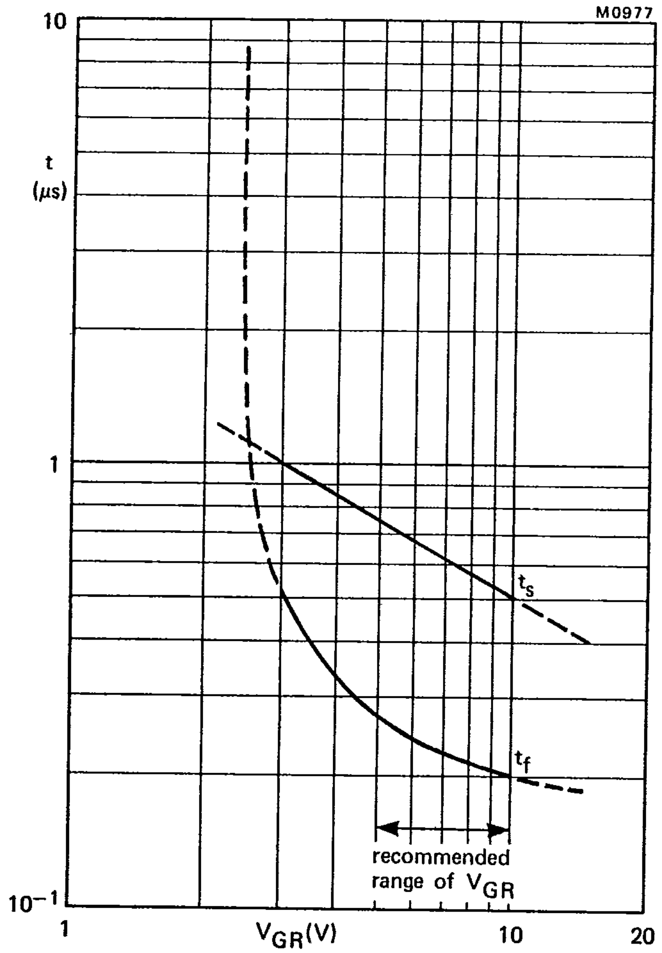


Fig. 16 Storage and fall times versus applied reverse gate voltage; inductive load; I_T = 2.5 A; L_G = 0.8 μH; I_G = 0.2 A; T_j = 25 °C; maximum values.

T-25-13

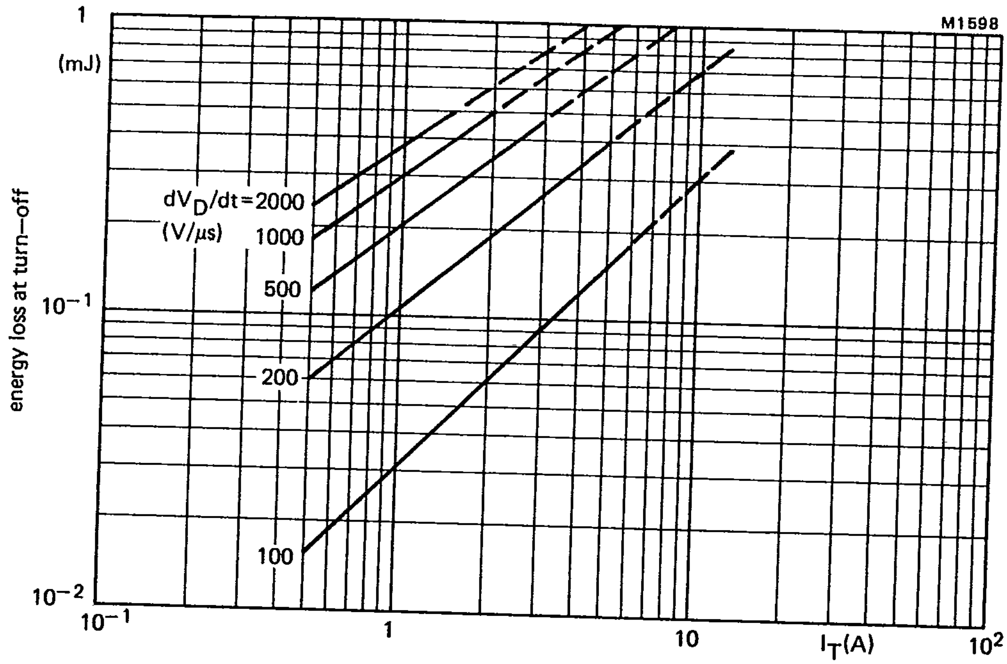


Fig.17 Maximum energy loss at turn-off (per cycle) as a function of anode current and applied dV_D/dt (calculated from I_T/C_S); reapplied voltage sinsusoidal up to V_{DRM} = 1200 V; V_{GR} = 10 V; I_G = 0.2 A; $L_G \leq$ 1.5 μH; $L_S \leq$ 0.25 μH; T_j = 120 °C.

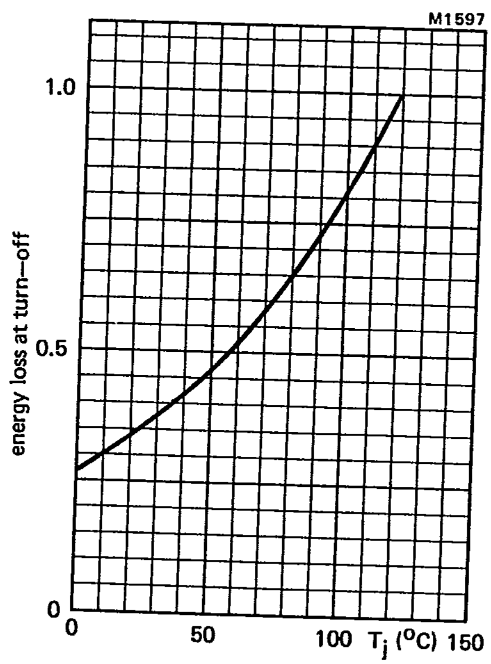


Fig.18 Energy loss at turn off as a function of junction temperature; I_G = 0.2 A; V_{GR} = 10 V. Normalised to T_j = 120 °C.