

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, motor control, 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.

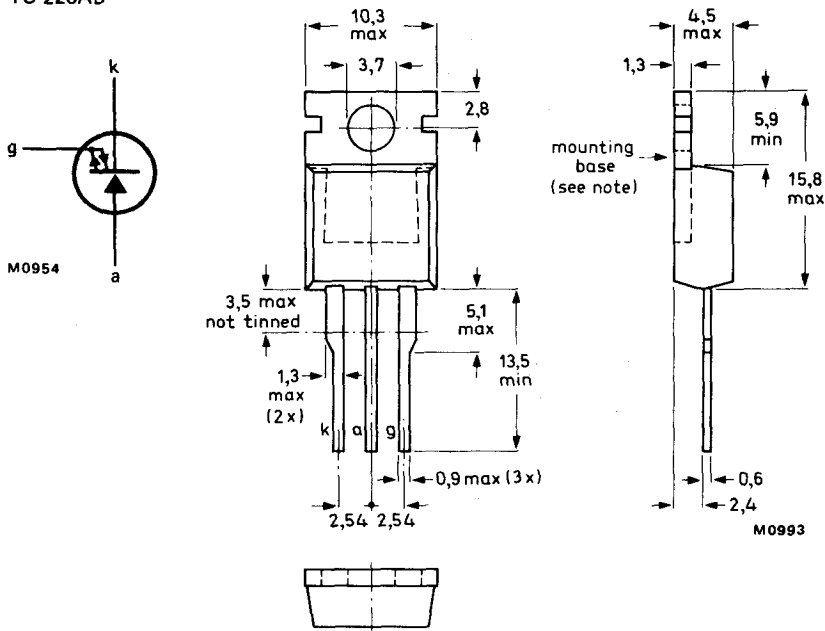
QUICK REFERENCE DATA

			BTW58-1000R	1300R	1500R	
Repetitive peak off-state voltage	V_{DRM}	max.	1000	1300	1500	V
Non-repetitive peak on-state current	I_{TSM}	max.		50		A
Controllable anode current	I_{TCRM}	max.		25		A
Average on-state current	$I_T(AV)$	max.		6.5		A
Fall time	t_f	<		250		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)

Anode to cathode			BTW58-1000R	1300R	1500R	
Transient off-state voltage	V_{DSM}	max.	1200	1500	1650	V*
Repetitive peak off-state voltage	V_{DRM}	max.	1000	1300	1500	V*
Working off-state voltage	V_{DW}	max.	650	1200	1300	V*
Continuous off-state voltage	V_D	max.	650	750	800	V*
Average on-state current (averaged over any 20 ms period) up to $T_{mb} = 85^\circ\text{C}$						
	$I_T(AV)$		max.		6.5	A
Controllable anode current						
	I_{TCRM}		max.		25	A
Non-repetitive peak on-state current $t = 10$ ms; half-sinewave; $T_j = 120^\circ\text{C}$ prior to surge						
	I_{TSM}		max.		50	A
I^2t for fusing; $t = 10$ ms						
	I^2t		max.		12.5	A ² s
Total power dissipation up to $T_{mb} = 25^\circ\text{C}$						
	P_{tot}		max.		65	W
Gate to cathode						
Repetitive peak on-state current $T_j = 120^\circ\text{C}$ prior to surge gate-cathode forward; $t = 10$ ms; half-sinewave						
	I_{GFM}		max.		25	A
gate-cathode reverse; $t = 20$ μ s						
	I_{GRM}		max.		25	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		$^\circ\text{C}$
Operating junction temperature						
	T_j		max.		120	$^\circ\text{C}$
THERMAL RESISTANCE						
From junction to mounting base						
	$R_{th\ j-mb}$	=			1.5	K/W
From mounting base to heatsink with heatsink compound						
	$R_{th\ mb-h}$	=			0.3	K/W
with 56367 alumina insulator and heatsink compound (clip-mounted)						
	$R_{th\ mb-h}$	=			0.8	K/W

*Measured with gate-cathode connected together.

CHARACTERISTICS**Anode to cathode**

On-state voltage

$I_T = 5 \text{ A}; I_G = 0.2 \text{ A}; T_j = 120^\circ \text{C}$

$V_T < 3.0 \text{ V}^*$

Rate of rise of off-state voltage that will not trigger any off-state device; exponential method
 $V_D = 2/3 V_{D\text{max}}; V_{GR} = 5 \text{ V}; T_j = 120^\circ \text{C}$

$dV_D/dt < 10 \text{ kV}/\mu\text{s}$

Rate of rise of off-state voltage that will not trigger any device following conduction, linear method
 $I_T = 5 \text{ A}; V_D = V_{DRM\text{max}}; V_{GR} = 10 \text{ V}; T_j = 120^\circ \text{C}$

$dV_D/dt < 1.5 \text{ kV}/\mu\text{s}$

Off-state current

$V_D = V_{D\text{max}}; T_j = 120^\circ \text{C}$

$I_D < 3.0 \text{ mA}$

Latching current; $T_j = 25^\circ \text{C}$

$I_L \text{ typ. } 1.0 \text{ A}^{**}$

Gate to cathode

Voltage that will trigger all devices

$V_D = 12 \text{ V}; T_j = 25^\circ \text{C}$

$V_{GT} > 1.5 \text{ V}$

Current that will trigger all devices

$V_D = 12 \text{ V}; T_j = 25^\circ \text{C}$

$I_{GT} > 200 \text{ mA}$

Minimum reverse breakdown voltage

$I_{GR} = 1.0 \text{ mA}$

$V_{(BR)GR} > 10 \text{ V}$

Switching characteristics (resistive load)Turn-on when switched to $I_T = 5 \text{ A}$ from $V_D = 250 \text{ V}$

$\text{with } I_{GF} = 0.5 \text{ A}; T_j = 25^\circ \text{C}$

delay time

$t_d < 0.25 \mu\text{s}$

rise time

$t_r < 1.0 \mu\text{s}$

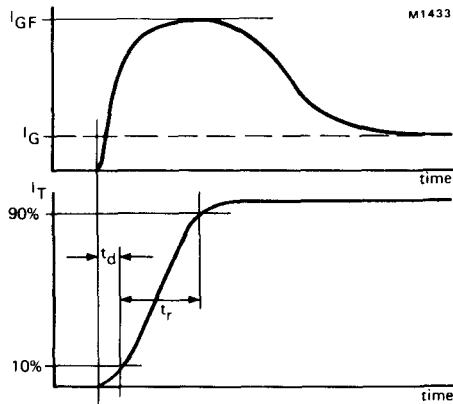


Fig.2 Waveforms

* 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 $I_T = 5 \text{ A}$ to $V_D = V_{DRMmax}$.

$V_{GR} = 10 \text{ V}$; $L_G \leq 1.0 \mu\text{H}$; $L_S \leq 0.25 \mu\text{H}$; $T_j = 25^\circ\text{C}$

storage time

$t_s < 0.5 \mu\text{s}$

fall time

$t_f < 0.25 \mu\text{s}$

peak reverse gate current

$I_{GR} < 6 \text{ A}$

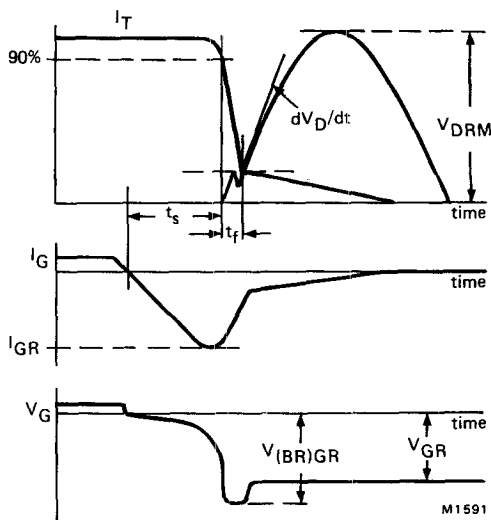


Fig.3 Waveforms.

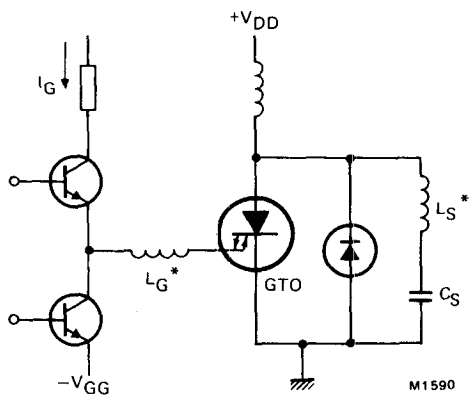


Fig.4 Inductive load test circuit

* Indicates stray series inductance only.

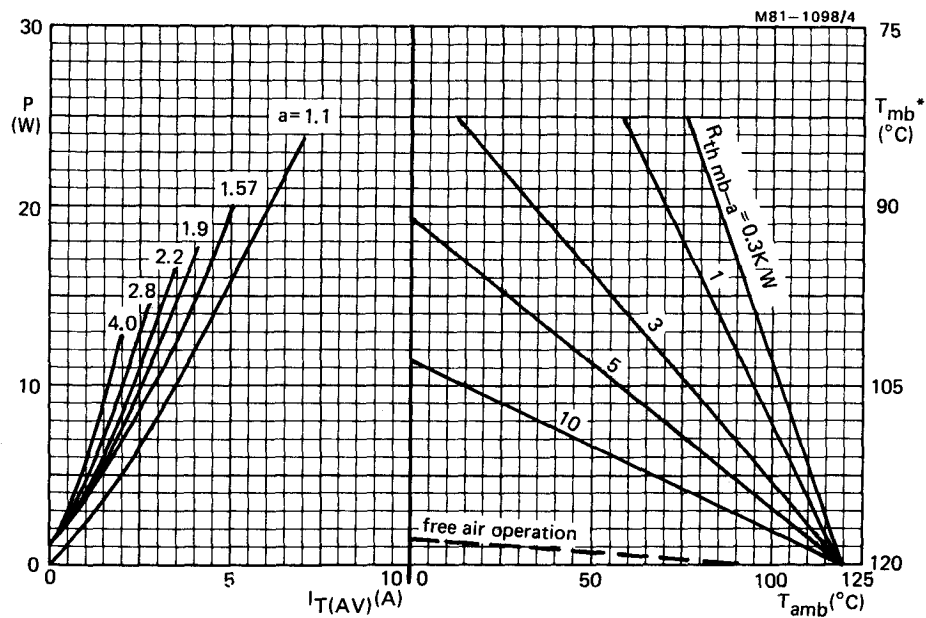


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

P = power excluding switching losses.

* T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb-a} < 9.6\ \text{K/W}$.

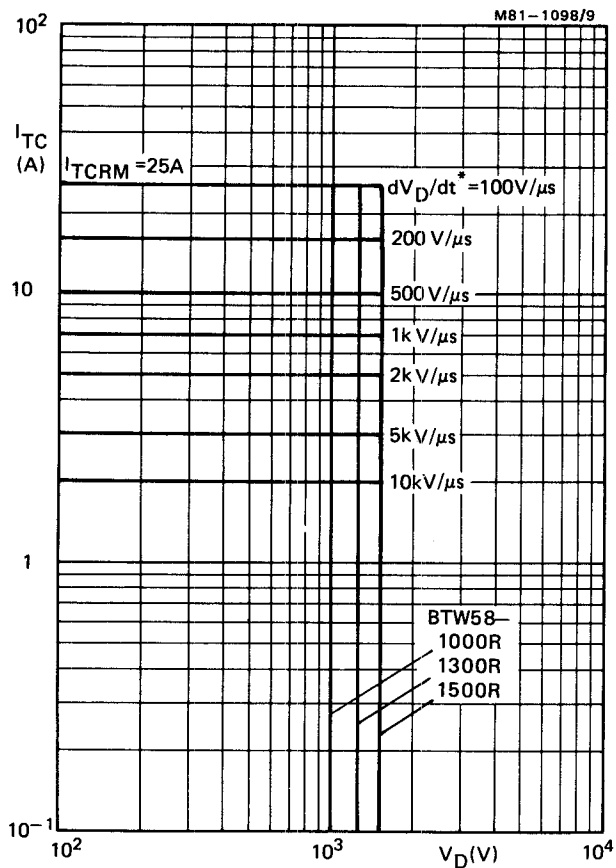


Fig.6 Anode current which can be turned off versus anode voltage; inductive load; $V_{GR} = 10 V$; $L_G \leq 1.0 \mu H$; $L_S \leq 0.25 \mu H$; $T_j = 85^\circ C$.
 $*dV_D/dt$ is calculated from I_T/C_S .

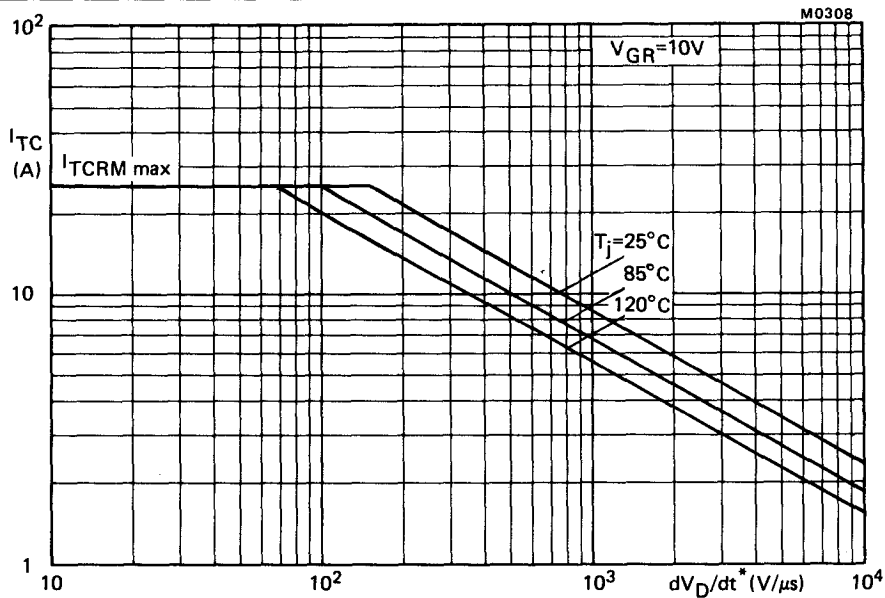


Fig.7 Anode current which can be turned off versus applied dV_D/dt^* ; inductive load; $V_{GR} = 10V$; $L_G \leq 1.0\ \mu H$; $L_S \leq 0.25\ \mu H$. * dV_D/dt is calculated from I_T/C_S .

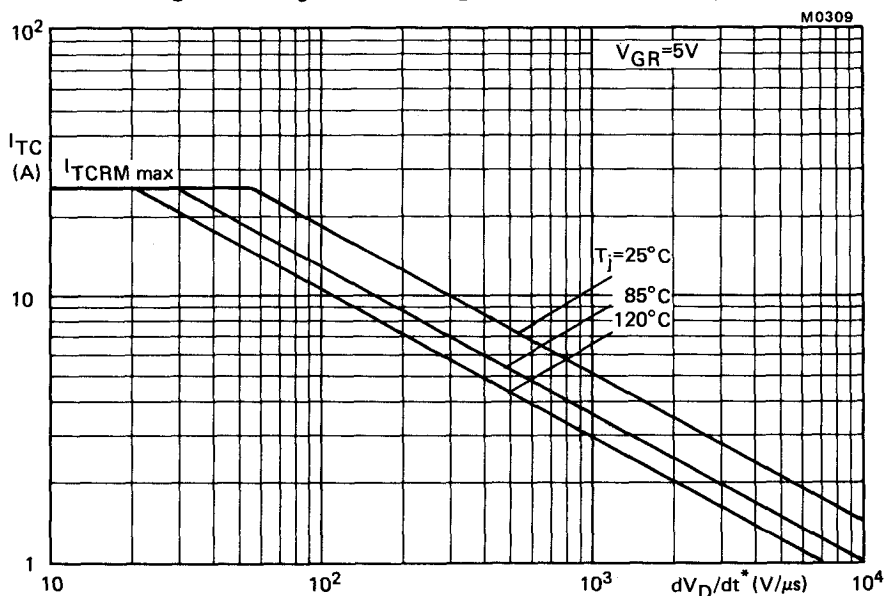


Fig.8 Anode current which can be turned off versus applied dV_D/dt^* ; inductive load; $V_{GR} = 5V$; $L_G \leq 1.0\ \mu H$; $L_S \leq 0.25\ \mu H$. * dV_D/dt is calculated from I_T/C_S .

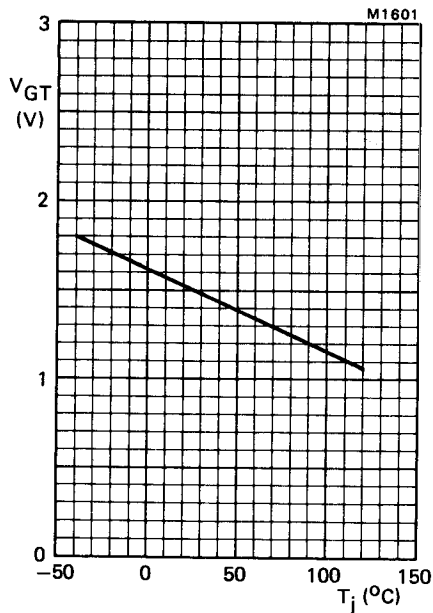


Fig.9 Minimum gate voltage that will trigger all devices as a function of junction temperature; $V_D = 12$ V.

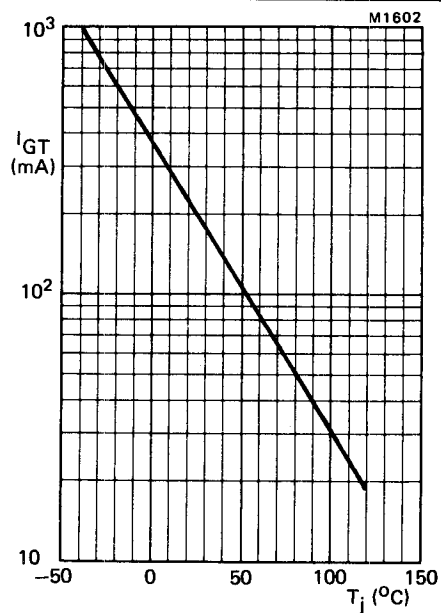


Fig.10 Minimum gate current that will trigger all devices as a function of junction temperature; $V_D = 12$ V.

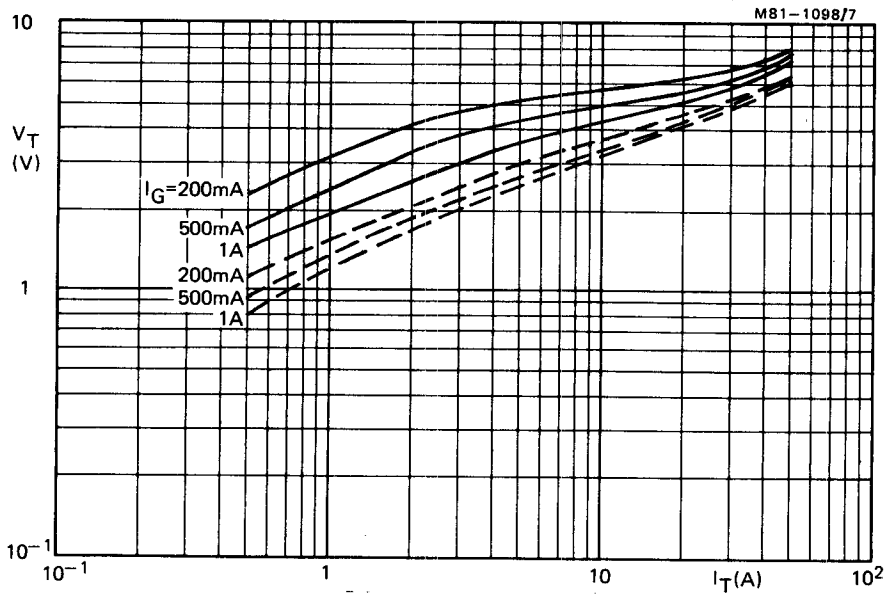


Fig.11 Maximum V_T versus I_T ; ——— $T_j = 25$ °C; - - - $T_j = 120$ °C.

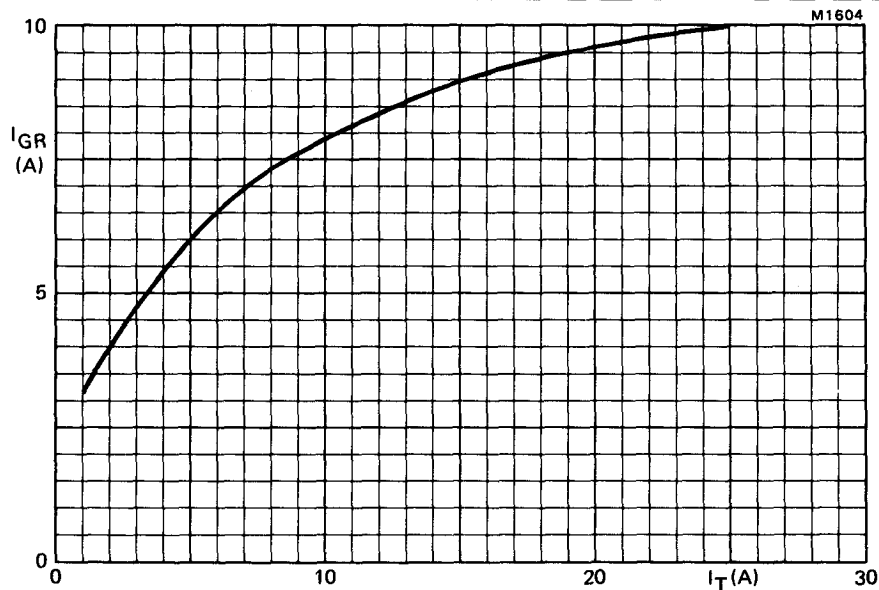


Fig.12 Peak reverse gate current versus anode current at turn-off; inductive load;
 $V_{GR} = 10$ V; $I_G = 0.2$ A; $L_G = 0.8$ μ H; $T_j = 120$ $^{\circ}$ C; maximum values.

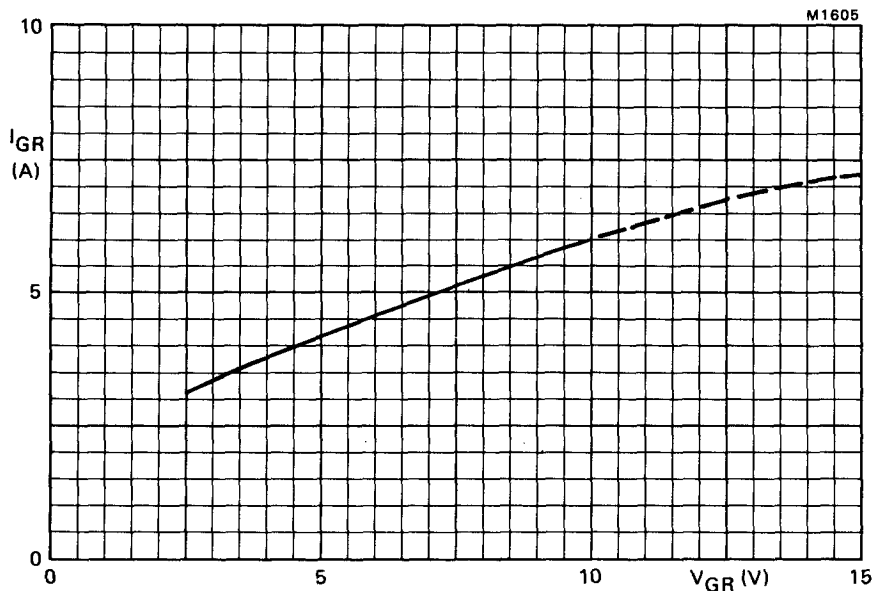


Fig.13 Peak reverse gate current versus applied reverse gate voltage; inductive load; $I_T = 5$ A;
 $I_G = 0.2$ A; $L_G = 0.8$ μ H; $T_j = 120$ $^{\circ}$ C; maximum values.

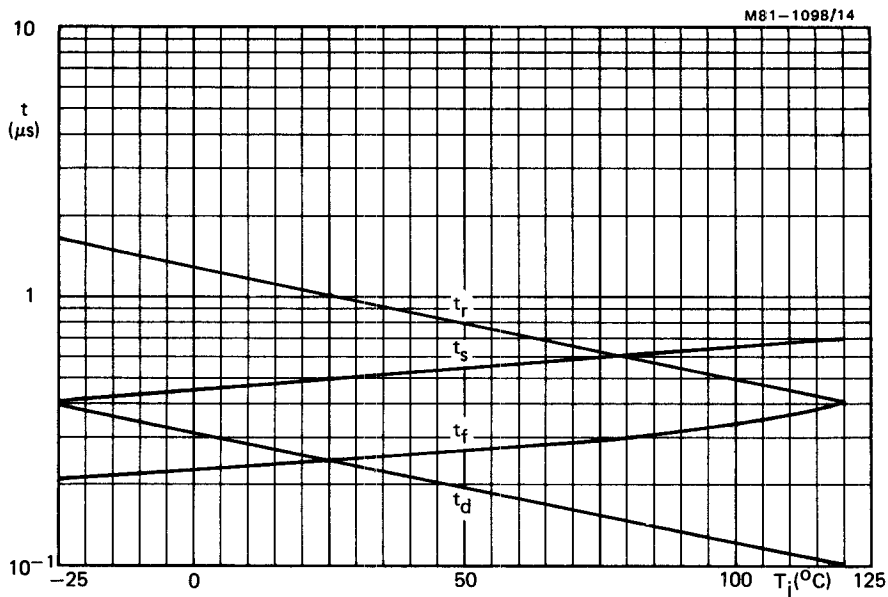


Fig.14 Switching times as a function of junction temperature; $V_D \geq 250$ V; $I_T = 5$ A; $I_{GF} = 0.5$ A; $V_{GR} = 10$ V; $I_G = 0.2$ A; $L_G = 0.8 \mu H$; maximum values.

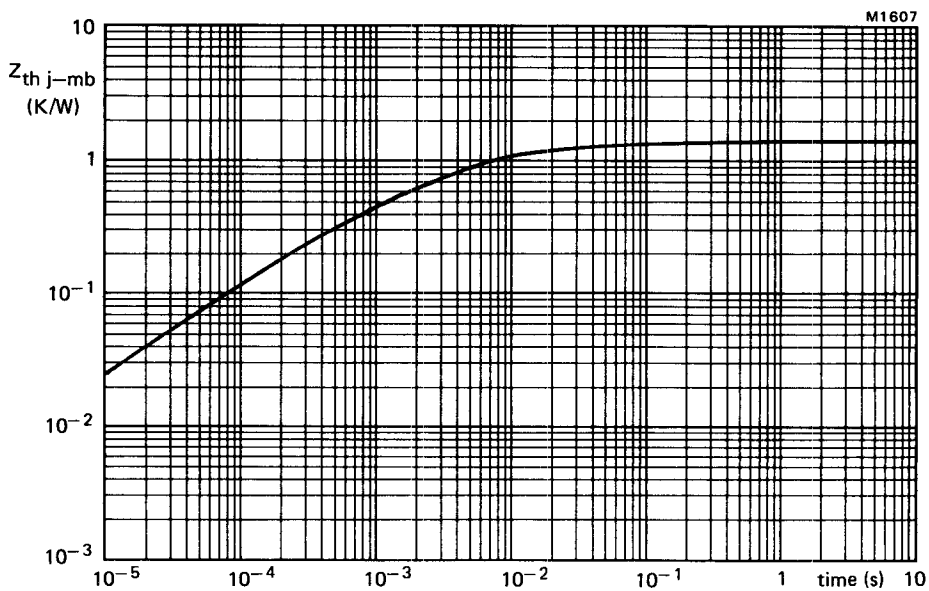


Fig.15 Transient thermal impedance.

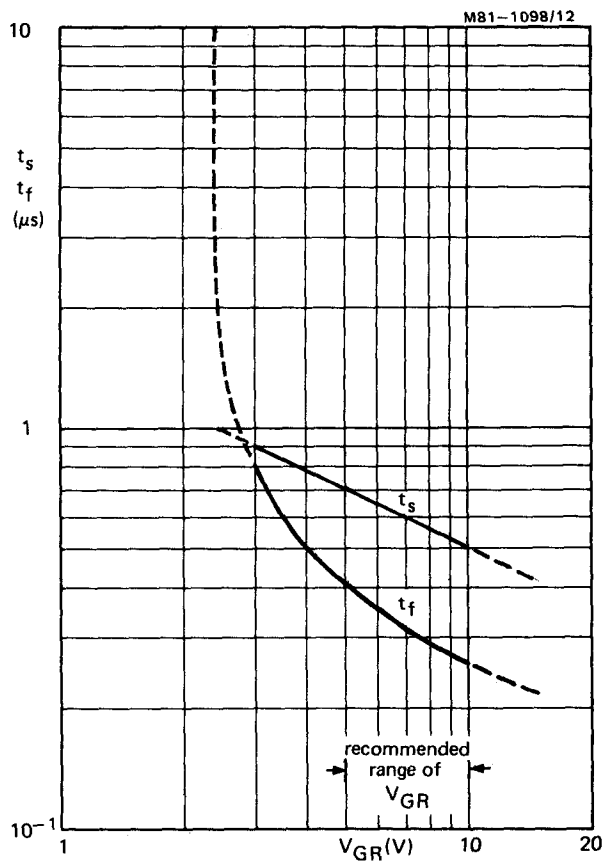


Fig.16 Storage and fall times versus applied reverse gate voltage; inductive load; $I_T = 5$ A; $I_G = 0.2$ A; $L_G = 0.8 \mu H$; $T_j = 25^\circ C$; maximum values.

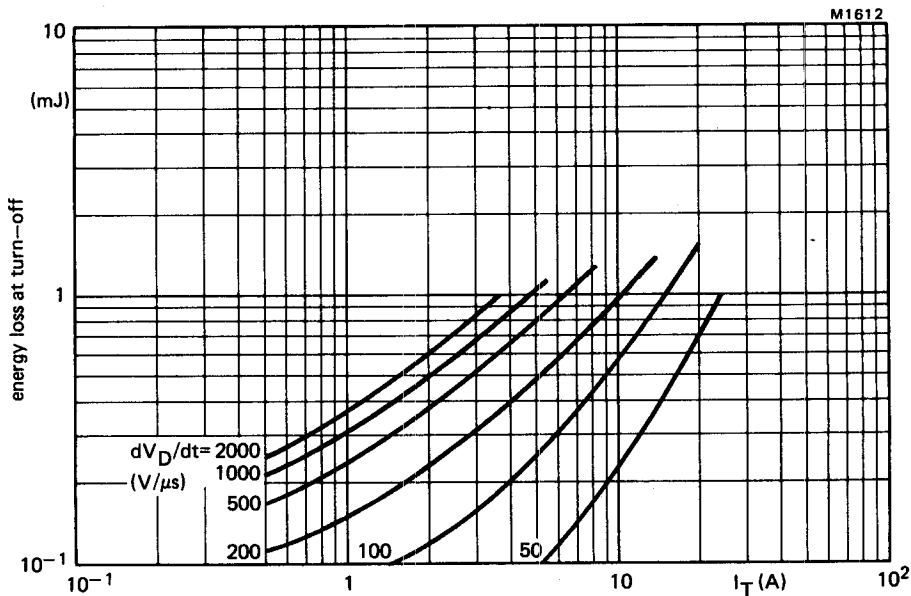


Fig.17 Maximum energy loss at turn-off (per cycle) as a function of anode current and applied dV_D/dt (calculated from I_T/C_S); reappplied voltage sinusoidal up to $V_{DRM} = 1200$ V; $V_{GR} = 10$ V; $I_G = 0.2$ A; $L_G \leq 1.0 \mu H$; $L_S \leq 0.25 \mu H$; $T_j = 120^\circ C$.

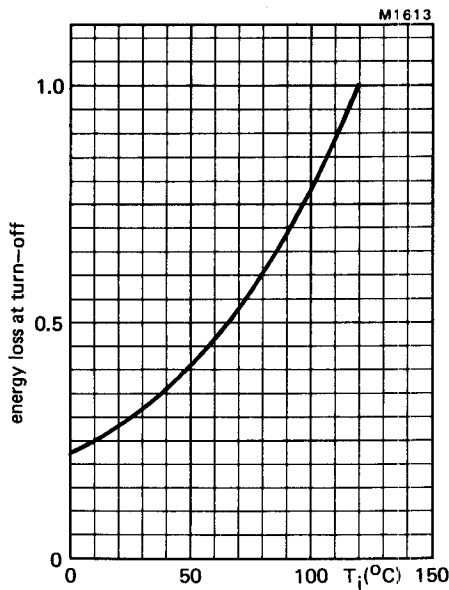


Fig.18 Energy loss at turn off as a function of junction temperature; $I_G = 0.2$ A; $V_{GR} = 10$ V. Normalised to $T_j = 120^\circ C$.