Key Parameters

V_{DSM}	=	5200 V
I_{TAVM}	=	1700 A
I_{TRMS}	=	2670 A
I_{TSM}	=	29000 A
V_{TO}	=	1.02 V
r_T	=	0.320 mΩ

Phase Control Thyristor
5STP 17L5200

Doc. No. 5SYA 1005-02 Dec.95

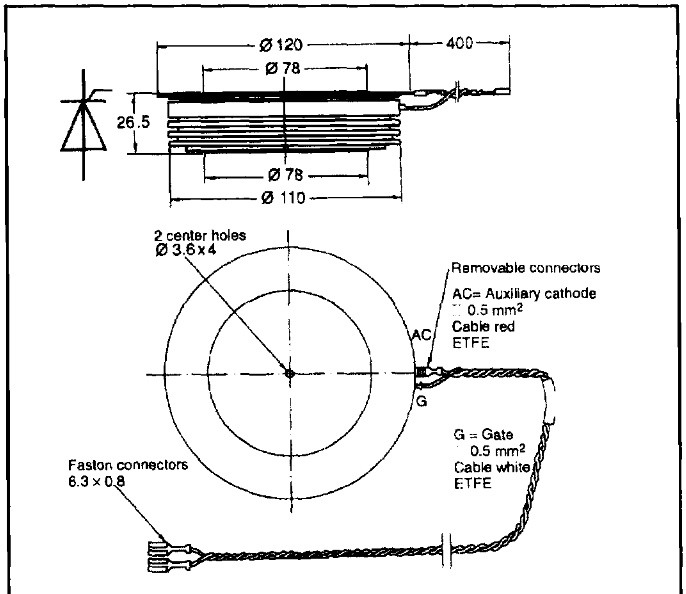
Features

- **Patented free-floating silicon technology**
- **Designed for traction, energy and industrial applications**
- **Optimum power handling capability**

Blocking

Part number	5STP 17L5200	5STP 17L5000	5STP 17L4600	Conditions	
V_{DSM} V_{RSM}	5200 V	5000 V	4600 V	f = 5Hz, t_p = 10ms	
V_{DRM} V_{RRM}	4400 V	4200 V	4000 V	f = 50Hz, t_p = 10ms	
V_{RSM1}	5700 V	5500 V	5100 V	t_p = 5ms, single pulse	
I_{DSM}	≤ 400 mA			V_{DSM}	T_{vj} = 125°C
I_{RSM}	≤ 400 mA			V_{RSM}	
dv/dt_{crit}	2000 V/µs		@ Exp.to 0.67xV_{DRM}		

V_{DRM}/V_{RRM} are equal to V_{DSM}/V_{RSM} values up to Tvj = 110°C.



Mechanical data

F_m	Mounting force	nom	50 kN
		min	45 kN
		max	60 kN
a	Acceleration Device clamped		100 m/s²
m	Weight		1.35 kg
D_s	Surface creepage distance		35 mm
D_a	Air strike distance		14 mm

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On-state

I_{TAVM}	Max. average on-state current	1700 A	Half sine wave, T_c = 70°C	
I_{TRMS}	Max. RMS on-state current	2670 A		
I_{TSM}	Max. peak non-repetitive surge current	29000 A	t_p = 10 ms	T_{vj} = 125°C
		31000 A	t_p = 8.3 ms	
I^2t	Limiting load integral	4205 kA²s	t_p = 10 ms	
		3990 kA²s	t_p = 8.3 ms	
V_T	On-state voltage	1.68 V	I_T = 2000 A	
V_{TO}	Threshold voltage	1.02 V		
r_T	Slope resistance	0.320 mΩ	I_T = 1000 - 3000 A	
I_H	Holding current	20-70 mA	T_{vj} = 25°C	
		15-60 mA	T_{vj} = 125°C	
I_L	Latching current	80-300 mA	T_{vj} = 25°C	
		70-250 mA	T_{vj} = 125°C	

Switching

di/dt_{crit}	Critical rate of rise of on-state current	100 A/µs	Cont.	$V_D \leq$ 0.67x V_{DRM} T_{vj} = 125°C I_{TRM} = 3000 A f = 50Hz
		200 A/µs	60 sec.	I_{FG} = 2.0 A t_r = 0.5µs
t_d	Delay time	≤ 3.0 µs	V_D =0.4xV_{DRM}	I_{FG} = 2.0 A t_r = 0.5µs
t_q	Turn-off time	≤ 700 µs	$V_D \leq$0.67xV_{DRM} dV_D/dt= 20 V/µs	I_{TRM} = 3000 A T_{vj} = 125°C V_R > 200 V di_T/dt= -5 A/µs
Q	Recovery charge min	4800 µAs		
	max	6200 µAs		

Triggering

V_{GT}	Gate trigger voltage	2.6 V	T_{vj} = 25°C
I_{GT}	Gate trigger current	400 mA	T_{vj} = 25°C
V_{GD}	Gate non-trigger voltage	0.3 V	V_D = 0.4xV_{DRM}
I_{GD}	Gate non-trigger DC current	10 mA	V_D = 0.4xV_{DRM}
V_{FGM}	Peak forward gate voltage	12 V	
I_{FGM}	Peak forward gate current	10 A	
V_{RGM}	Peak reverse gate voltage	10 V	
P_G	Gate power losses	3 W	

Thermal

$T_{vj\,max}$	Max. junction temperature	125 °C	
$T_{vj\,stg}$	Storage temperature range	-40.. ..150°C	
R_{thJC}	Thermal resistance junction to case	24 K/kW	Anode side cooled
		24 K/kW	Cathode side cooled
		12 K/kW	Double side cooled
R_{thCH}	Thermal resistance case to heat sink	10 K/kW	Single side cooled
		5 K/kW	Double side cooled

Analytical function for transient thermal impedance:

$$Z_{thJC} = \sum_{i=1}^{n} R_i(1-e^{-t/\tau_i})$$

i	1	2	3	4
R_i (K/W)	0.0053	0.0051	0.0016	
τ_i (s)	2.1838	0.4151	0.0324	

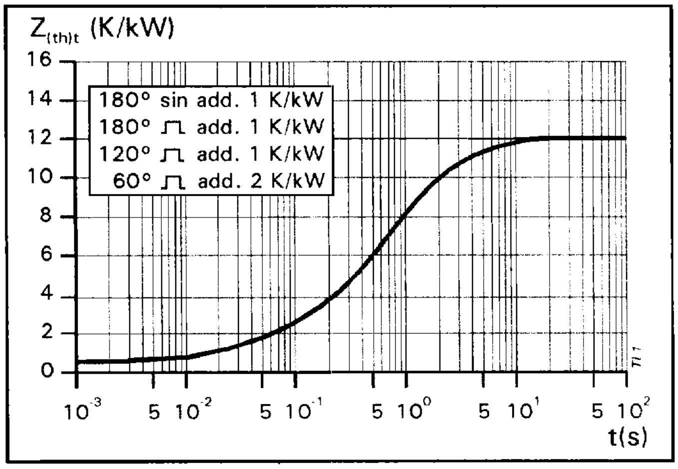


Fig.1 Transient thermal impedance, junction to case.

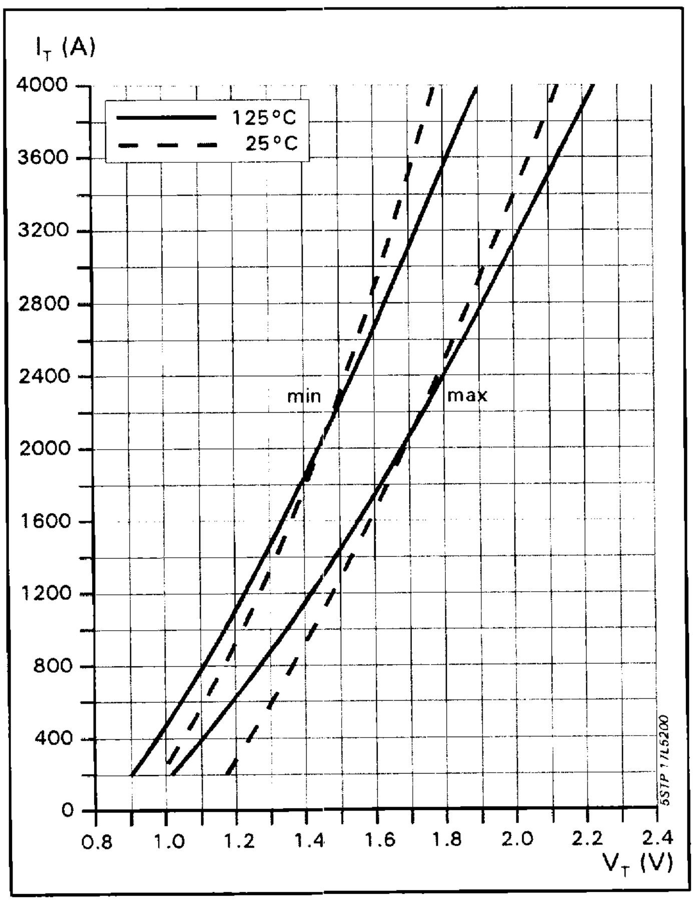


Fig.2 On-state characteristics.

Voltage drop model: $V_T = A + B*i_T + C*\ln(i_T+1) + D*\sqrt{i_T}$

Valid for I_T = 500 - 4000 A

A	B	C	D
1.309000	0.000080	-0.125000	0.026000

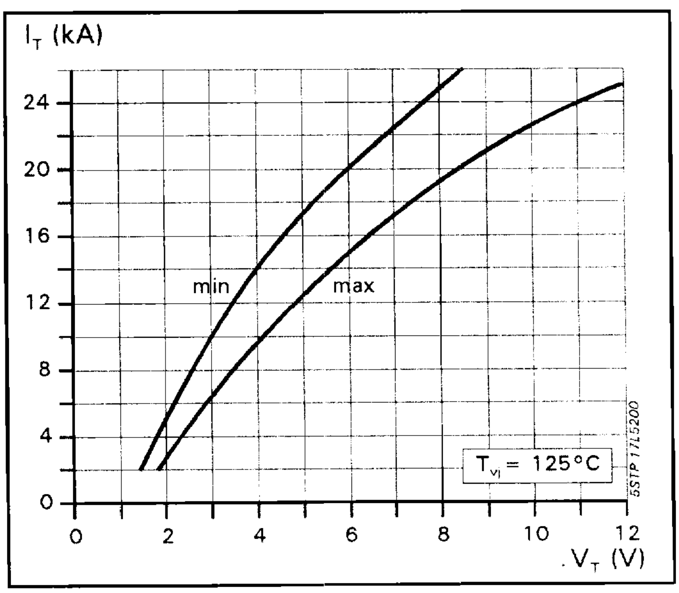


Fig.3 On-state characteristics.

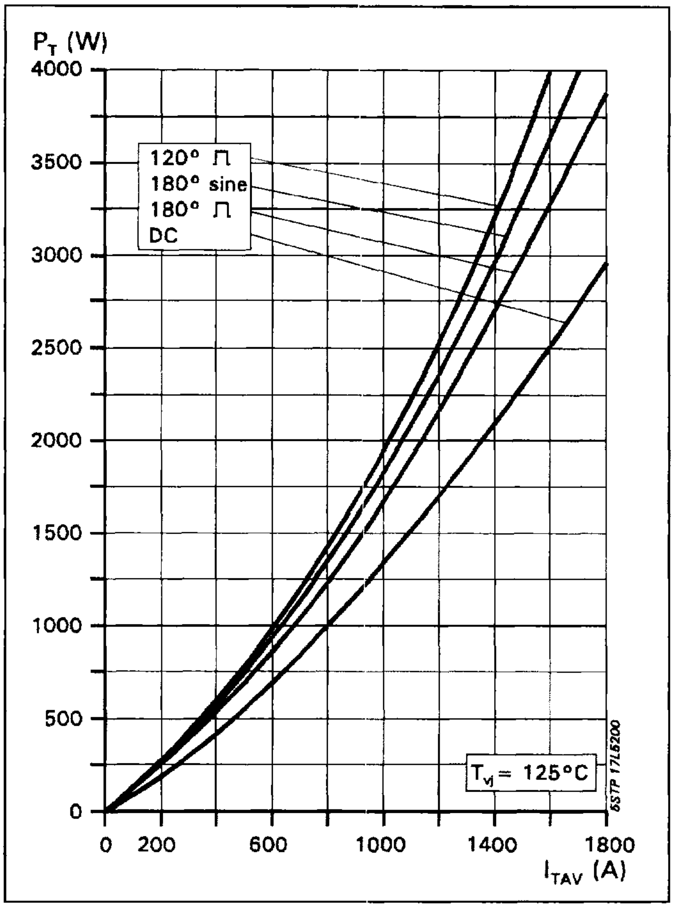


Fig.4 On-state power loss vs mean on-state current. Turn-on losses excluded.

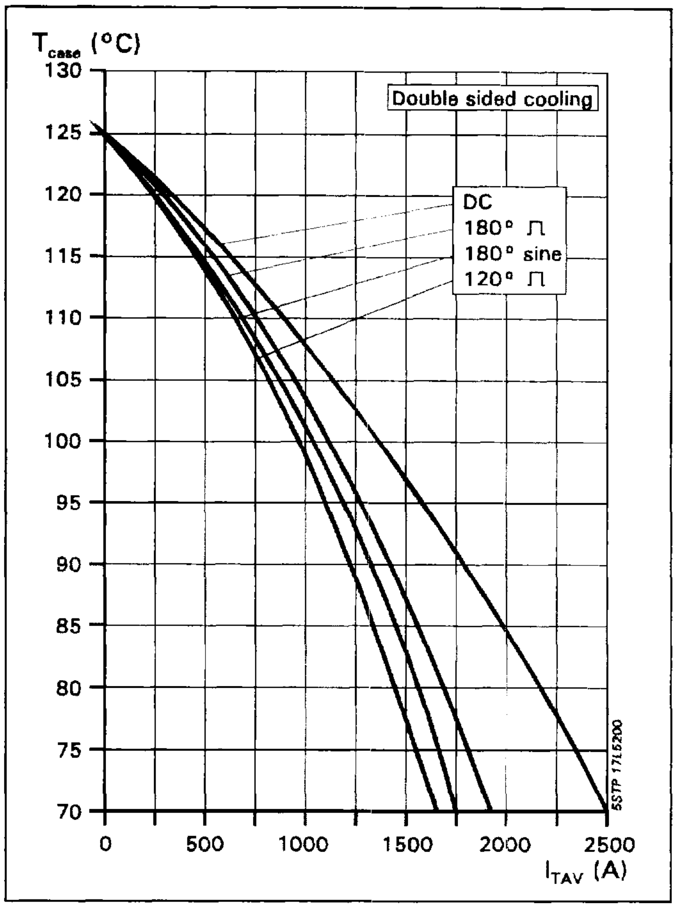


Fig.5 Max. permissible case temperature vs mean on-state current.

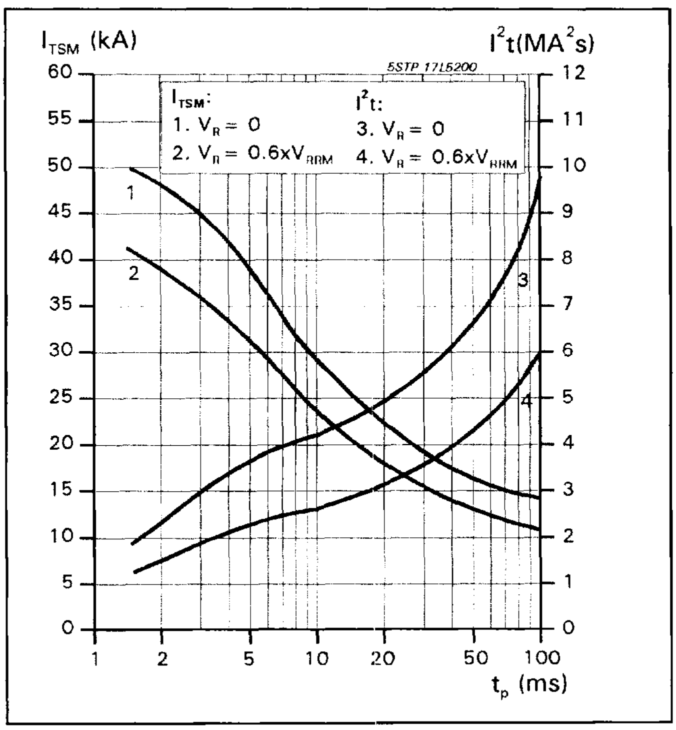


Fig.6 Surge on-state current vs pulse length. Half-sine wave.

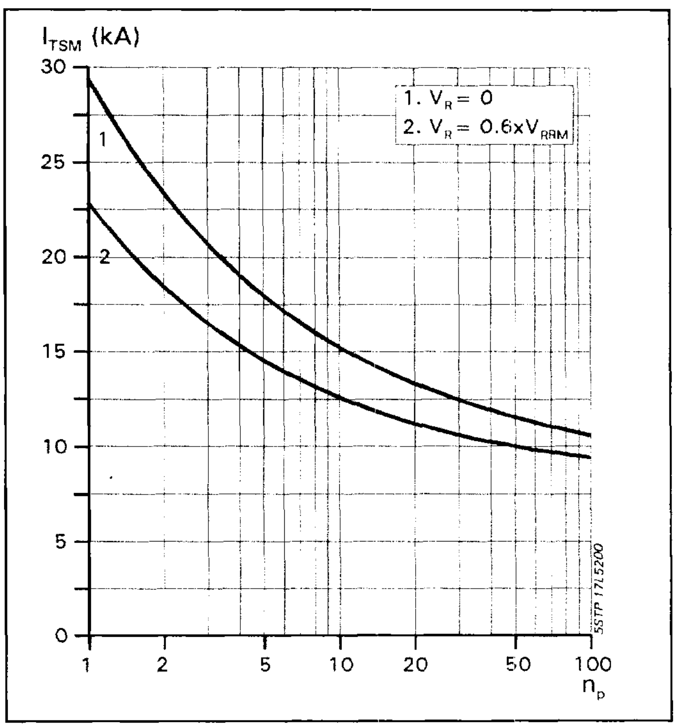


Fig.7 Surge on-state current vs number of pulses. Half-sine wave, 10ms, 50Hz.

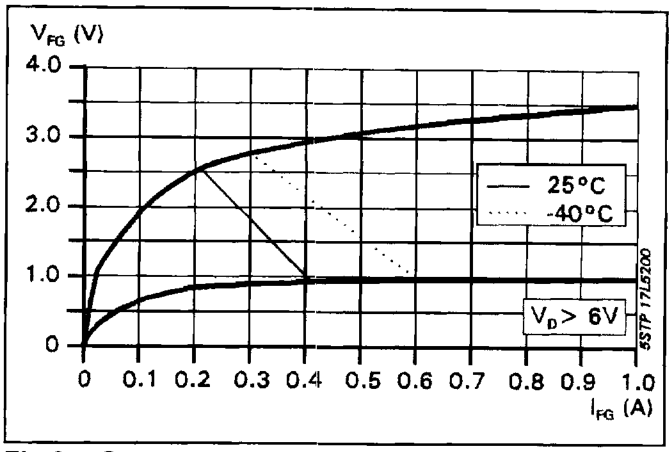


Fig.8 Gate trigger characteristics.

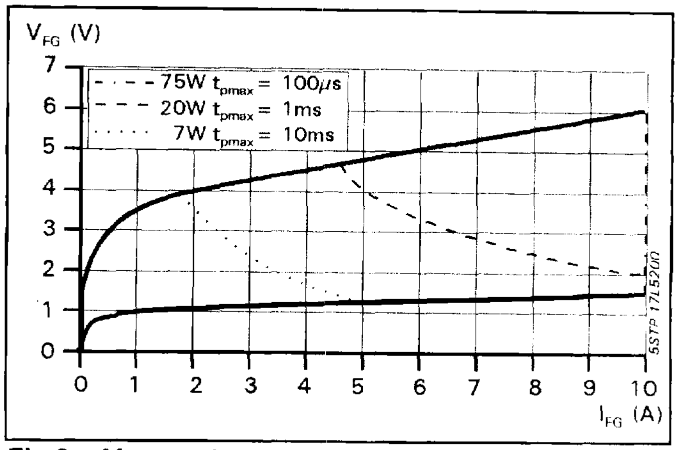


Fig.9 Max. peak gate power loss.

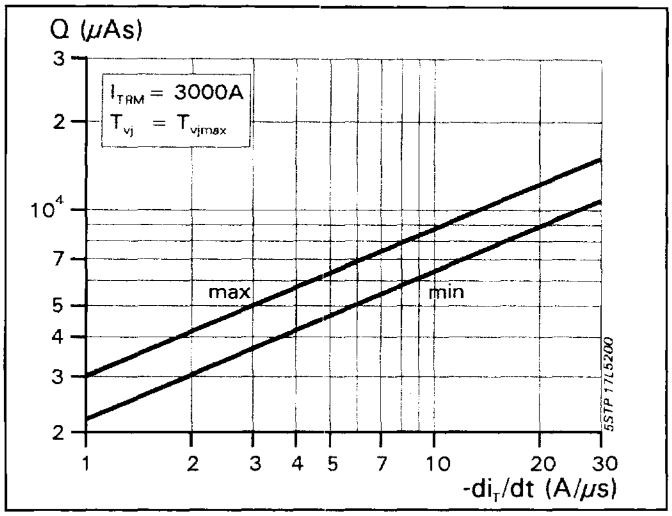


Fig.10 Recovery charge vs decay rate of on-stat current.

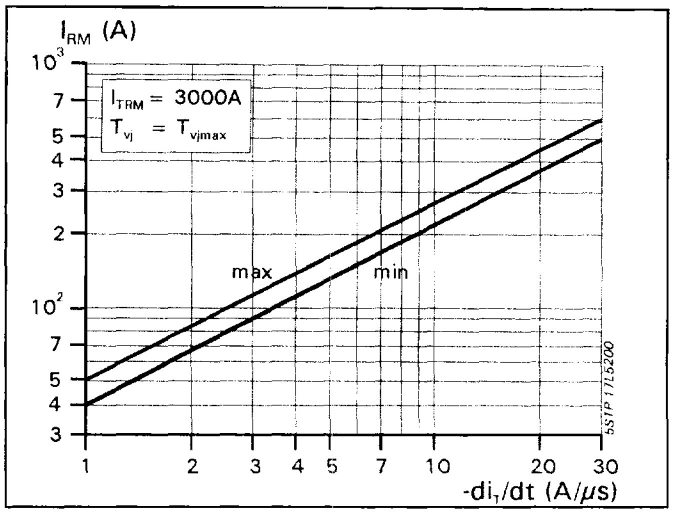


Fig.11 Peak reverse recovery current vs decay rate of on-state current.

Turn-off time, typical parameter relationship

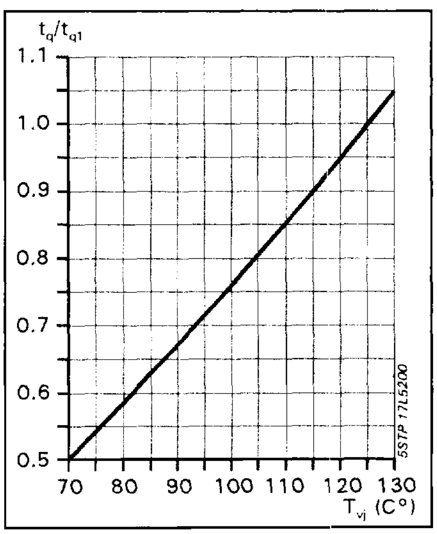


Fig.12 $t_q/t_{q1} = f(T_{vj})$

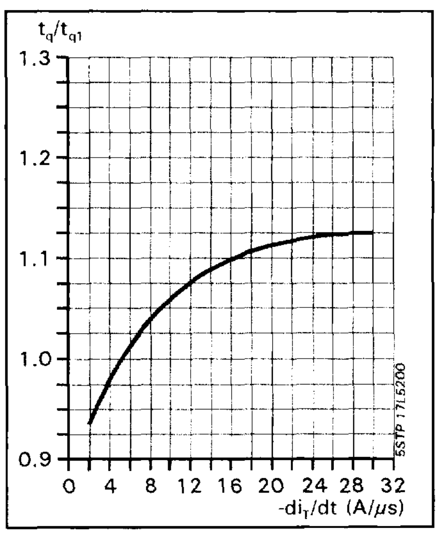


Fig.13 $t_q/t_{q1} = f(-di/dt)$

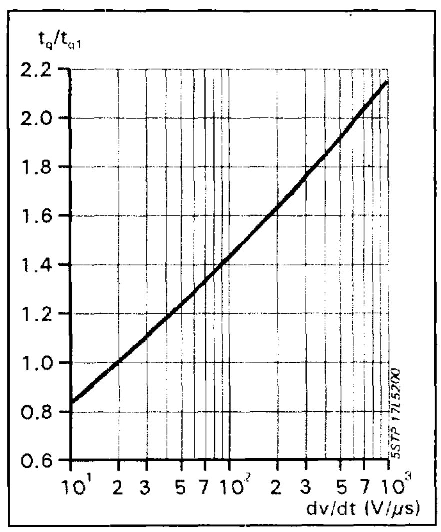


Fig.14 $t_q/t_{q1} = f(dv/dt)$

$t_q = t_{q1} \cdot t_q/t_{q1}(T_{vj}) \cdot t_q/t_{q1}(-di/dt) \cdot t_q/t_{q1}(dv/dt)$

t_{q1} : at normalized value (see page 2).
t_q : at varying conditions.

Turn-on and Turn-off losses

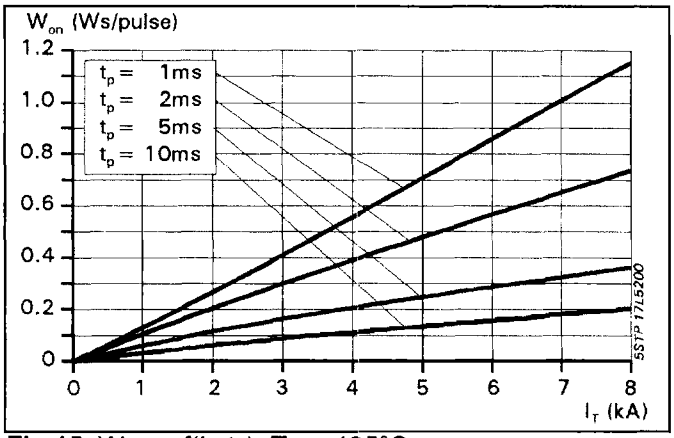


Fig.15 Won = f(IT,tp), Tvj = 125°C.
Half sinusodial waves.

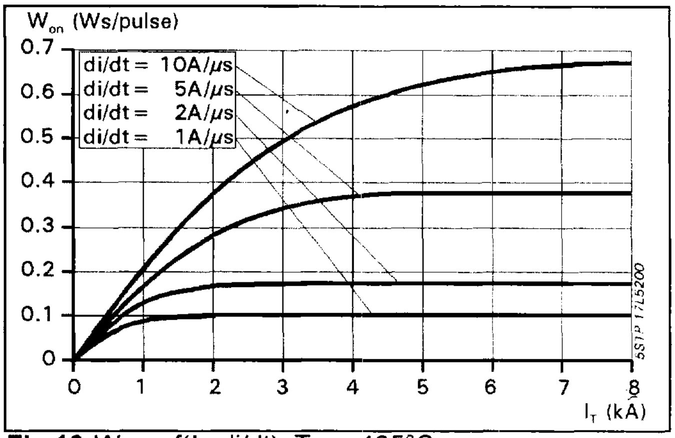


Fig.16 Won = f(IT,di/dt), Tvj = 125°C.
Rectangular waves.

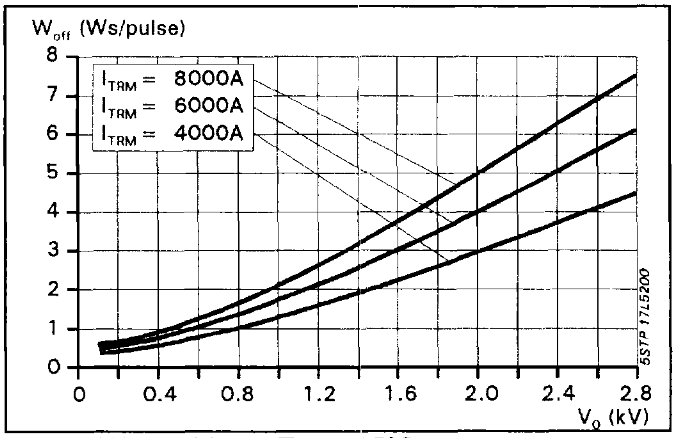


Fig.17 Woff = f(Vo,IT), Tvj = 125°C.
Half sinusodial waves. Tp= 10ms.

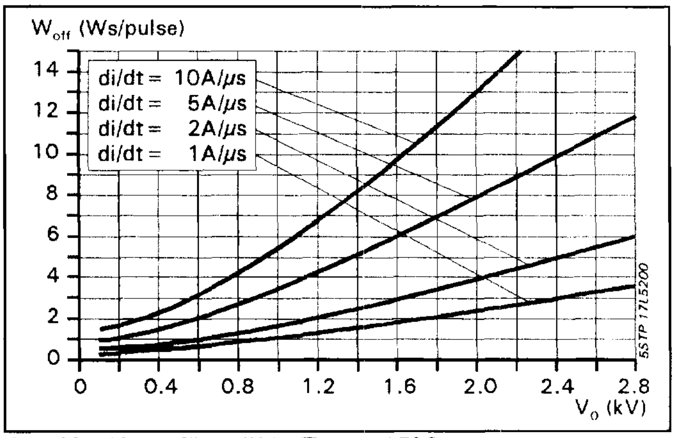
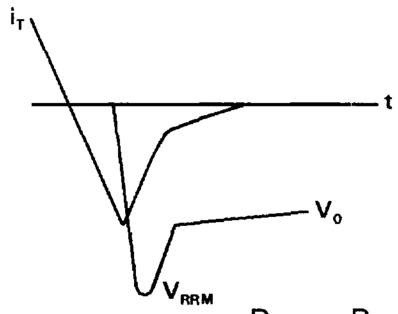


Fig.18 Woff = f(Vo,di/dt) Tvj = 125°C.
Rectangular waves.



$P_{TOT} = P_T + W_{on} * f + W_{off} * f$

W_{off} at V_{RRM} / V_o = 1.3-1.5

$P_T = \frac{1}{T} \int_0^T i_T * v_T \, dt$

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