V_{SM}	=	5200 V
I_{TAVM}	=	1800 A
I_{TRMS}	=	2830 A
I_{TSM}	=	29000 A
V_{T0}	=	1.02 V
r_T	=	0.320 mΩ

Bi-Directional Control Thyristor

5STB 17N5200

Doc. No. 5SYA1036-03 Sep. 01

- **Two thyristors integrated into one wafer**
- **Patented free-floating silicon technology**
- **Designed for traction, energy and industrial applications**
- **Optimum power handling capability**
- **Interdigitated amplifying gate.**

The electrical and thermal data are valid for one thyristor half of the device.

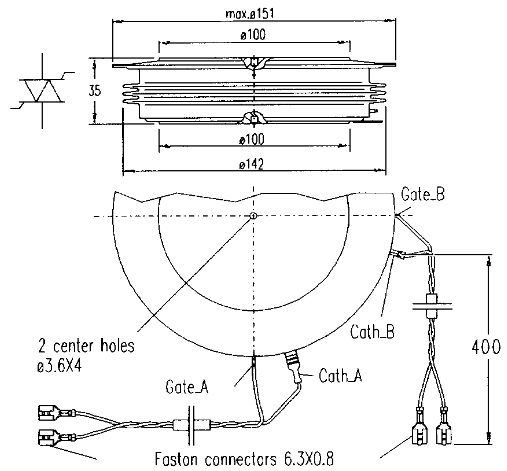
Blocking

Part Number	5STB 17N5200	5STB 17N5000	5STB 17N4600	Conditions	
V_{SM}	5200 V	5000 V	4600 V	f = 5 Hz, t_p = 10ms	
V_{RM}	4400 V	4200 V	4000 V	f = 50 Hz, t_p = 10ms	
I_{SM}	≤ 400 mA			V_{SM}	T_j = 125°C
I_{RM}	≤ 400 mA			V_{RM}	
dV/dt_{crit}	2000 V/µs		@ Exp. to $0.67xV_{SM}$		

V_{RM} is equal to V_{SM} up to T_j = 110°C

Mechanical data

F_M	Mounting force	nom.	90 kN
		min.	81 kN
		max.	108 kN
a	Acceleration Device unclamped Device clamped		 50 m/s² 100 m/s²
m	Weight		2.9 kg
D_S	Surface creepage distance		53 mm
D_a	Air strike distance		22 mm



On-state

I_{TAVM}	Max. average on-state	1800 A	Half sine wave, T_C = 70°C
I_{TRMS}	Max. RMS on-state current	2830 A	
I_{TSM}	Max. peak non-repetitive surge current	29000 A	tp = 10 ms; T_j = 125°C, After surge: $V_D = V_R$ = 0V
		31000 A	tp = 8.3 ms
I^2t	Limiting load integral	4205 kA^2s	tp = 10 ms
		3990 kA^2s	tp = 8.3 ms
V_T	On-state voltage	1.68 V	I_T = 2000 A; T_j = 125°C
V_{T0}	Threshold voltage	1.02 V	I_T = 1000 - 3000 A
r_T	Slope resistance	0.320 mΩ	
I_H	Holding current	50-250 mA	T_j = 25°C
		25-150 mA	T_j = 125°C
I_L	Latching current	100-500 mA	T_j = 25°C
		50-300 mA	T_j = 125°C

Switching

di/dt_{crit}	Critical rate of rise of on-state current	250 A/µs	Cont. f = 50 Hz	$V_D \le 0.67 \cdot V_{DRM}$, T_j = 125°C I_{TRM} = 3000 A I_{FG} = 2 A, t_r = 0.5 µs
		500 A/µs	60 sec. f = 50Hz	
t_d	Delay time	≤ 3.0 µs	$V_D = 0.4 \cdot V_{DRM}$	I_{FG} = 2 A, t_r = 0.5 µs
t_q	Turn-off time	≤ 700 µs	$V_D \le 0.67 \cdot V_{DRM}$ dv_D/dt = 20V/µs	I_{TRM} = 3000 A, T_j = 125°C V_R > 200 V, di_T/dt = -1.5 A/µs
Q_{rr}	Recovery charge min	4000 µAs		
	max	5200 µAs		

Triggering

V_{GT}	Gate trigger voltage	≤ 2.6 V	T_j = 25°C	
I_{GT}	Gate trigger current	≤ 400 mA	T_j = 25°C	
V_{GD}	Gate non-trigger voltage	≥ 0.3 V	$V_D = 0.4 \cdot V_{RM}$	T_j = 125°C
I_{GD}	Gate non-trigger current	≥ 10 mA	$V_D = 0.4 \cdot V_{RM}$	T_j = 125°C
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	Maximum gate power loss	3 W		

Thermal

T_j	Operating junction temperature range	-40…125 °C	
T_{stg}	Storage temperature range	-40…150 °C	
R_{thJC}	Thermal resistance junction to case	22.8 K/kW	Anode side cooled
		22.8 K/kW	Cathode side cooled
		11.4 K/kW	Double side cooled
R_{thCH}	Thermal resistance case to heat sink	4 K/kW	Single side cooled
		2 K/kW	Double side cooled

Analytical function for transient thermal impedance:

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

i	1	2	3	4
R_i(K/kW)	6.77	2.51	1.34	0.78
τ_i(s)	0.8651	0.1558	0.0212	0.0075

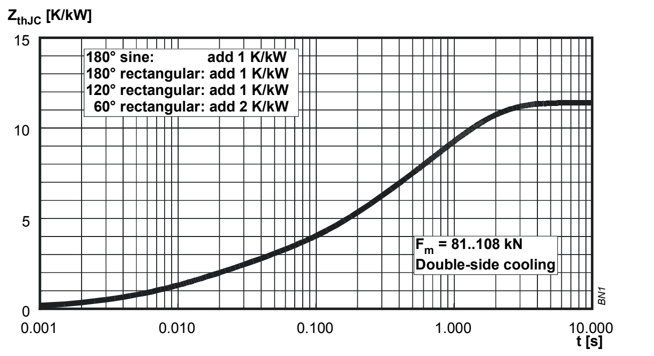


Fig. 1 Transient thermal impedance junction to case.

On-state characteristic model:

$$VT = A + B \cdot iT + C \cdot \ln(iT + 1) + D \cdot \sqrt{IT}$$

Valid for i_T = 500 – 4000 A

A	B	C	D
1.309	0.00008	-0.125	0.026

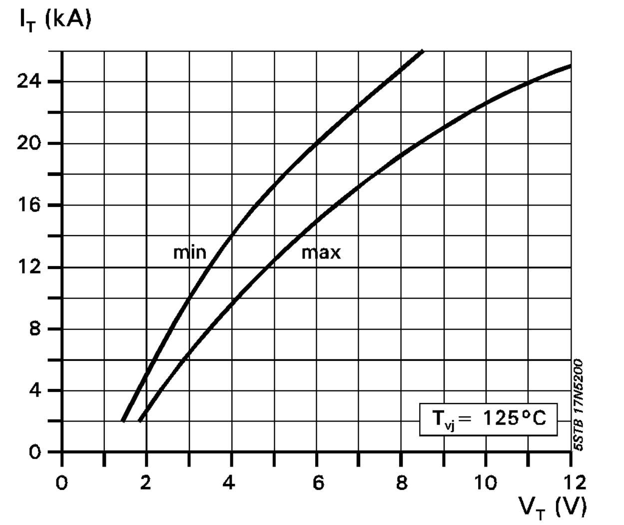


Fig. 2 On-state characteristics.

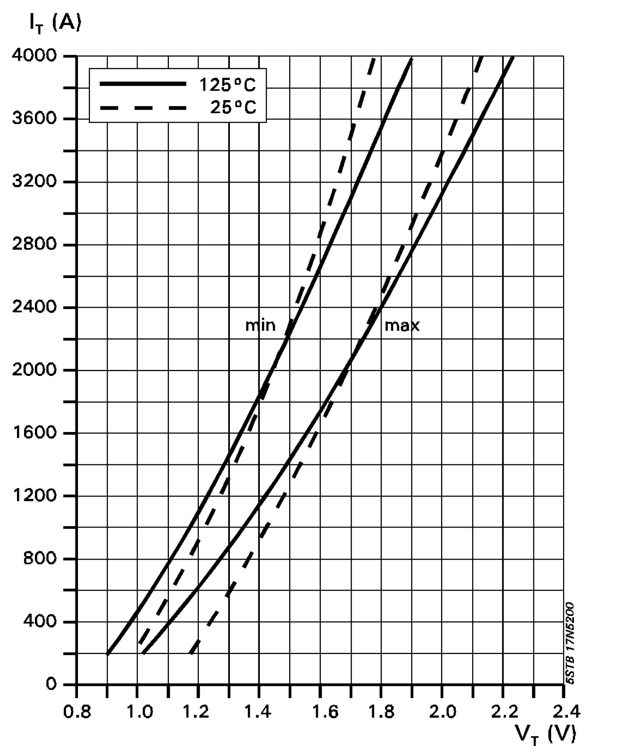


Fig. 3 On-state characteristics.

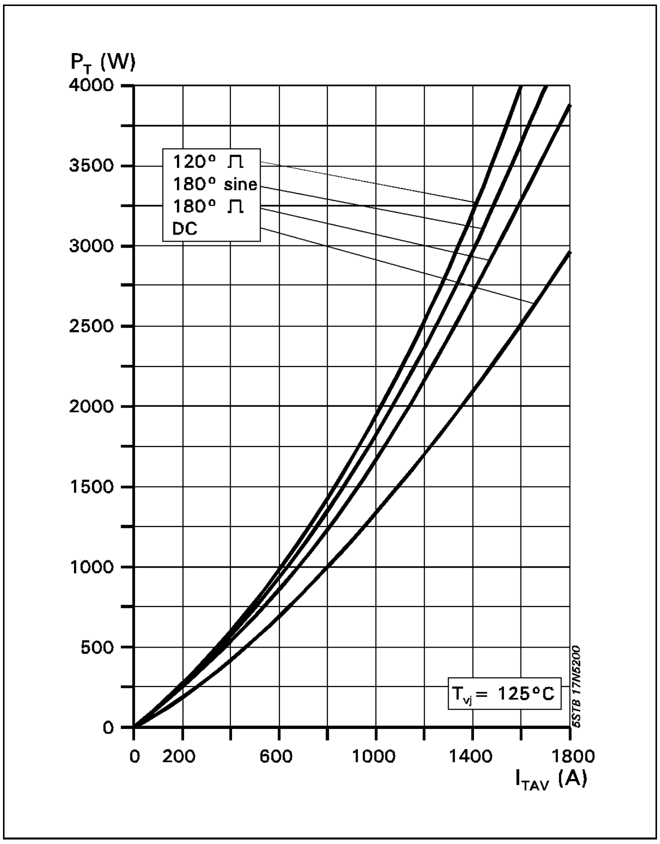


Fig. 4 On-state power dissipation vs. mean on-state current. Turn - on losses excluded.

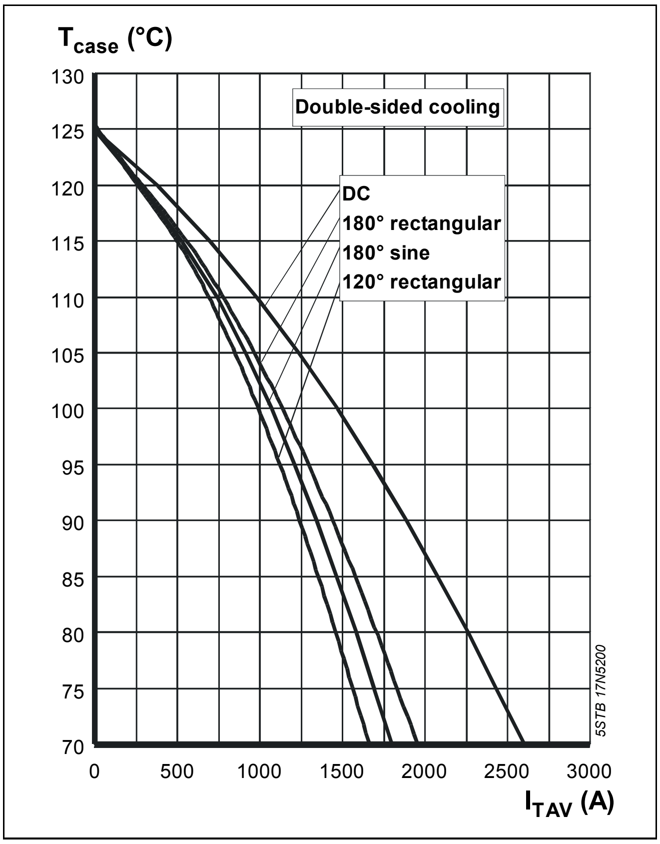


Fig. 5 Max. permissible case temperature vs. mean on-state current.

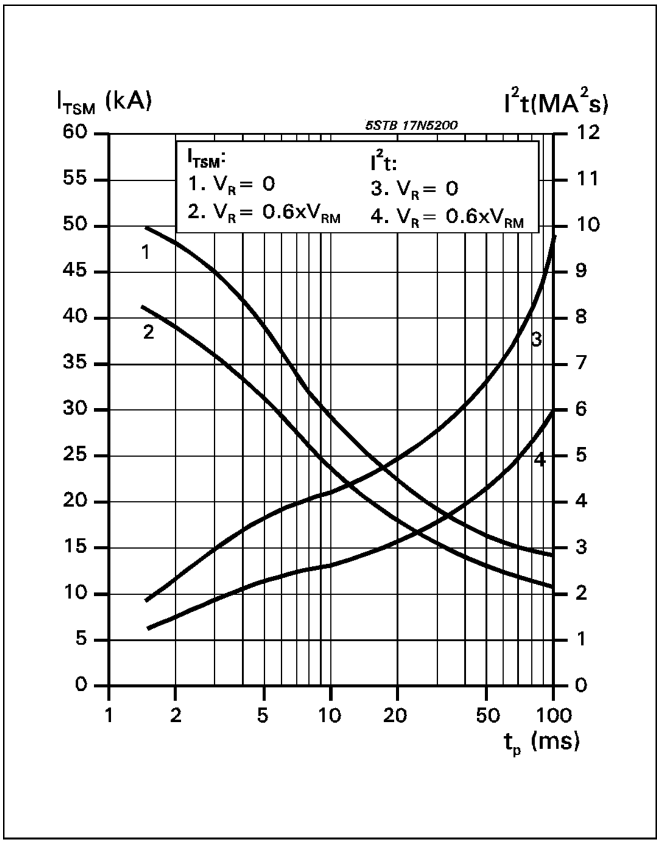


Fig. 6 Surge on-state current vs. pulse length. Half-sine wave.

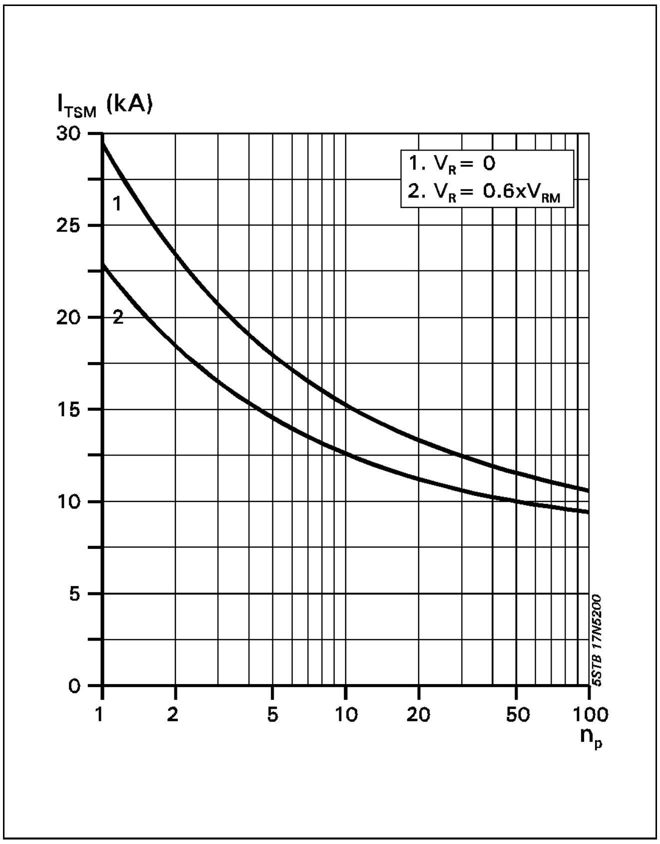


Fig. 7 Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.

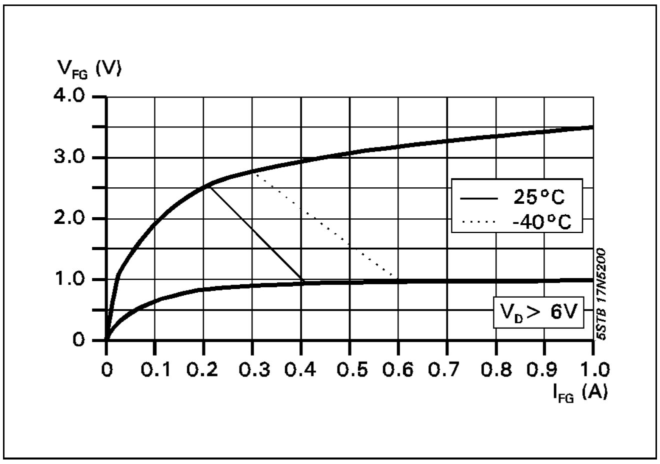


Fig. 8 Gate trigger characteristics.

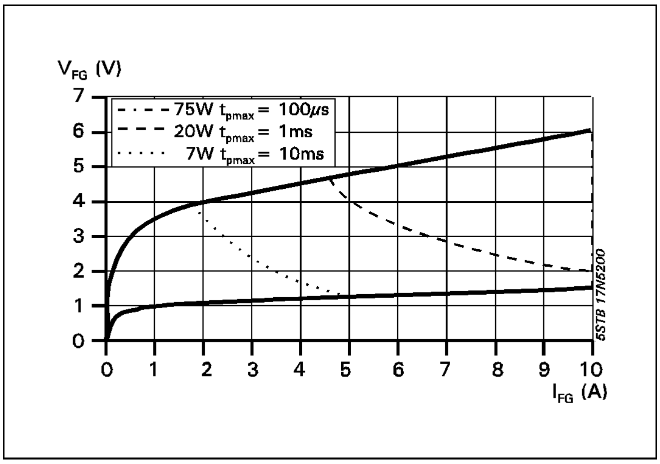


Fig. 9 Max. peak gate power loss.

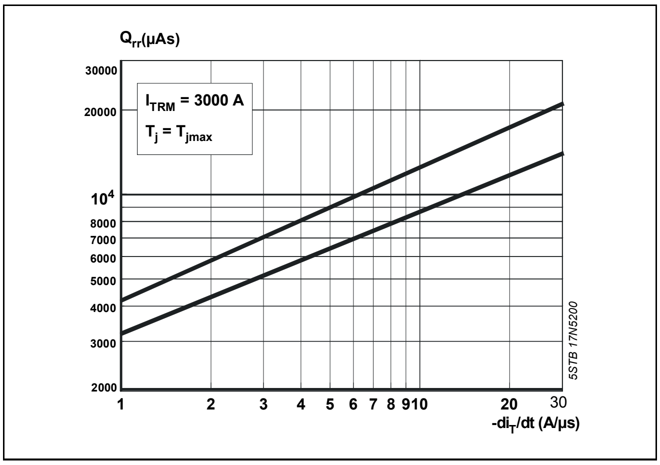


Fig. 10 Recovery charge vs. decay rate of on-state current.

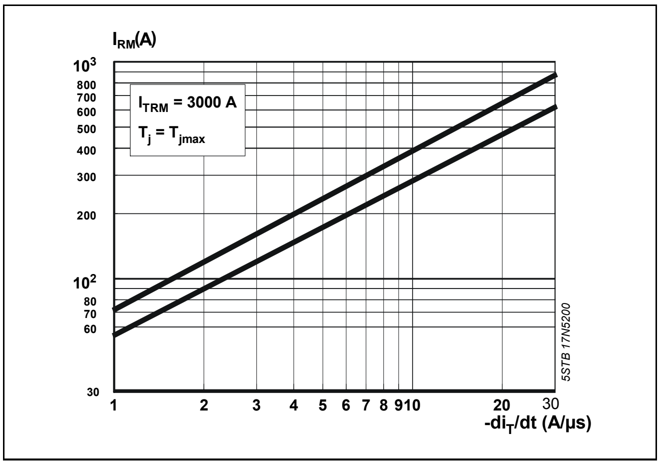


Fig. 11 Peak reverse recovery current vs. decay rate of on-state current.

Turn - off time, typical parameter relationship.

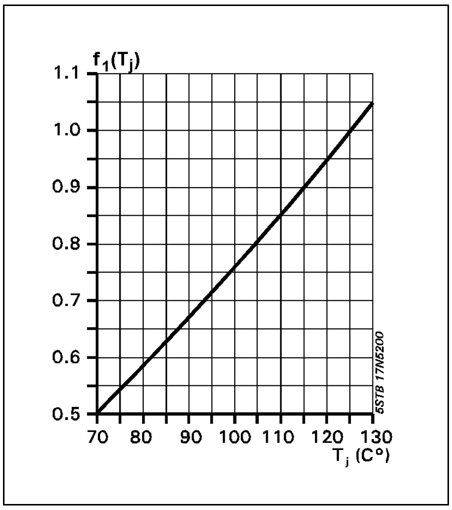


Fig. 12 $t_q/t_{q1} = f_1(T_j)$

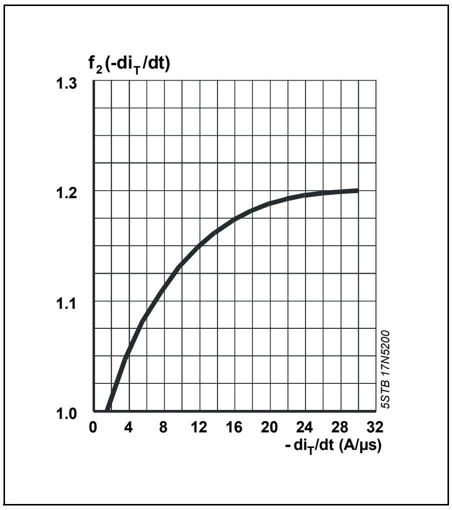


Fig. 13 $t_q/t_{q1} = f_2(-di_T/dt)$

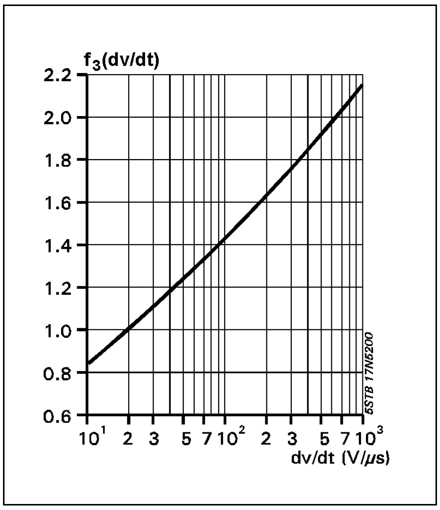


Fig. 14 $t_q/t_{q1} = f_3(dv/dt)$

$t_q = t_{q1} \bullet f_1(T_j) \bullet f_2(-di_T/dt) \bullet f_3(dv/dt)$

t_{q1} :at normalized values (see page 2)

t_q : at varying conditions

Turn-on and Turn-off losses

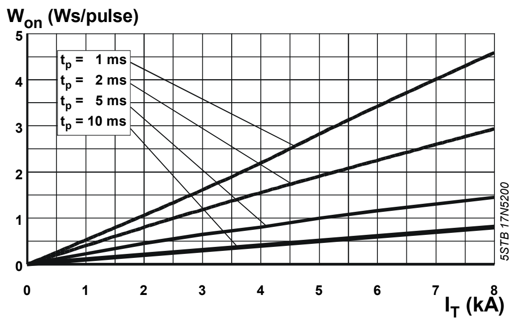


Fig. 15 $W_{on} = f(I_T, t_P)$, T_j = 125 °C.
Half sinusoidal waves.

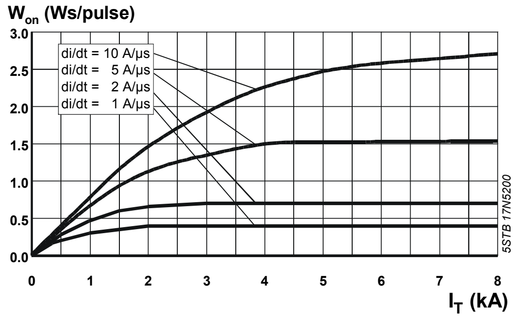


Fig. 16 $W_{on} = f(I_T, di/dt)$, T_j = 125 °C.
Rectangular waves.

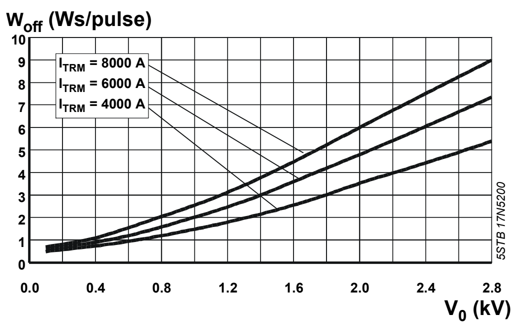


Fig. 17 $W_{off} = f(V_0, I_T)$, T_j = 125 °C.
Half sinusoidal waves. t_P = 10 ms.

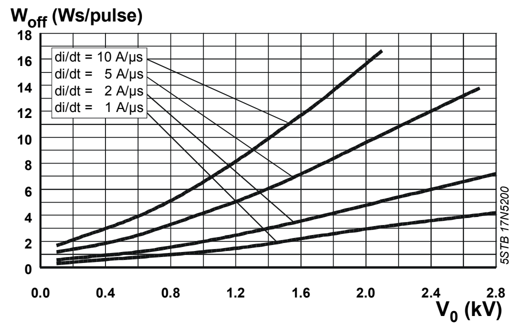
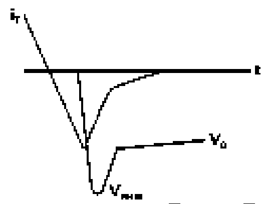


Fig. 18 $W_{off} = f(V_0, di/dt)$, T_j = 125 °C.
Rectangular waves.



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

W_{off} at V_{RRM}/V_0 = 1.3-1.5

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

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