

V_{DM}	$=$	5200 V	<h1 style="margin: 0;">Bi-Directional Control Thyristor</h1> <h2 style="margin: 0;">5STB 17N5200</h2>
$I_{T(AV)M}$	$=$	1800 A	
$I_{T(RMS)}$	$=$	2830 A	
I_{TSM}	$=$	$29 \times 10^3\text{ A}$	
V_{T0}	$=$	1.02 V	
r_T	$=$	0.32 mW	

Doc. No. 5SYA1036-04 May 07

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

The electrical and thermal data are valid for one-thyristor-half of the device (unless otherwise stated)

Blocking

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	5STB 17N5200	Unit
Max. surge peak forward blocking voltage	V_{SM}	$t_p = 10\text{ ms}$, $f = 5\text{ Hz}$ T_{vj} $= 5 \dots 125^\circ\text{C}$, Note 1	5200	V
Max repetitive peak forward blocking voltage	V_{RM}	$f = 50\text{ Hz}$, $t_p = 10\text{ ms}$, $t_{p1} = 250\ \mu\text{s}$, $T_{vj} = 5 \dots 125^\circ\text{C}$, Note 1	5200	V
Max crest working forward voltages	V_{WM}		2600	V
Critical rate of rise of offstate voltage	dv/dt_{crit}		Exp. to 2950 V, $T_{vj} = 125^\circ\text{C}$	2000

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Max reverse leakage current	I_{RM}	V_{RM} , $T_{vj} = 125^\circ\text{C}$			400	mA

Note 1: Voltage de-rating factor of 0.11% per $^\circ\text{C}$ is applicable for T_{vj} below $+5^\circ\text{C}$

Note 2: Recommended minimum ratio of V_{DRM} / V_{DWM} or $V_{RRM} / V_{RWM} = 2$. See App. Note 5SYA 2051.

Mechanical data

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	F_M		81	90	108	kN
Acceleration	a	Device unclamped			50	m/s^2
Acceleration	a	Device clamped			100	m/s^2

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
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Weight	m			2.9	kg
Housing thickness	H	$F_M = 90 \text{ kN}, T_a = 25 \text{ }^\circ\text{C}$	34.8	35.4	mm
Surface creepage distance	D_S		53		mm
Air strike distance	D_a		22		mm

1) Maximum rated values indicate limits beyond which damage to the device may occur **ABB Switzerland Ltd**,

Semiconductors reserves the right to change specifications without notice.

On-state

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Average on-state current	$I_{T(AV)M}$	Half sine wave, $T_c = 70 \text{ }^\circ\text{C}$			1800	A
RMS on-state current	$I_{T(RMS)}$				2830	A
RMS on-state current	$I_{T(RMS)}$	Full sine wave, $T_c = 70 \text{ }^\circ\text{C}$			4000	A
Peak non-repetitive surge current	I_{TSM}	$t_p = 10 \text{ ms}, T_{vj} = 125 \text{ }^\circ\text{C}$, sine wave after surge: $V_D = V_R = 0 \text{ V}$			29.0×10^3	A
Limiting load integral	I^2t				4.21×10^6	A ² s
Peak non-repetitive surge current	I_{TSM}	$t_p = 8.3 \text{ ms}, T_{vj} = 125 \text{ }^\circ\text{C}$, sine wave after surge: $V_D = V_R = 0 \text{ V}$			31.0×10^3	A
Limiting load integral	I^2t				3.99×10^6	A ² s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_T	$I_T = 2000 \text{ A}, T_{vj} = 125 \text{ }^\circ\text{C}$			1.68	V
Threshold voltage	V_{T0}	$I_T = 1000 \text{ A} - 3000 \text{ A}, T_{vj} = 125 \text{ }^\circ\text{C}$			1.02	V
Slope resistance	r_T				0.32	m Ω
Holding current	I_H	$T_{vj} = 25 \text{ }^\circ\text{C}$	50		250	mA
		$T_{vj} = 125 \text{ }^\circ\text{C}$			150	mA
Latching current	I_L	$T_{vj} = 25 \text{ }^\circ\text{C}$			500	mA
		$T_{vj} = 125 \text{ }^\circ\text{C}$			300	mA

Switching

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Critical rate of rise of onstate current	di/dt_{crit}	$T_{vj} = 125 \text{ }^\circ\text{C}$, $I_{TRM} = 3000 \text{ A}$, Cont. $f = 50 \text{ Hz}$			250	A/ μs
Critical rate of rise of onstate current	di/dt_{crit}	$V_D \leq 2950 \text{ V}$, $I_{FG} = 2 \text{ A}, t_r = 0.5 \text{ } \mu\text{s}$ Cont. $f = 1 \text{ Hz}$			500	A/ μs
Circuit commutated turn-off time	t_q	$T_{vj} = 125 \text{ }^\circ\text{C}, I_{TRM} = 2000 \text{ A}$, $V_R = 200 \text{ V}, di_T/dt = -1.5 \text{ A}/\mu\text{s}$, $V_D \leq 0.67 \cdot V_{RM}, dv_D/dt = 20 \text{ V}/\mu\text{s}$,	700			μs
Critical rate of rise of commutating voltage	dv/dt_{com}	$T_{vj} = 125 \text{ }^\circ\text{C}, V_R \leq 0.67 \cdot V_{RM}$			500	V/ μs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Reverse recovery charge	Q_{rr}	$T_{vj} = 125 \text{ }^\circ\text{C}, I_{TRM} = 2000 \text{ A}$, $V_R = 200 \text{ V}, di_T/dt = -1.5 \text{ A}/\mu\text{s}$	3500		6500	μAs
Reverse recovery current	I_{RM}		65		90	A

Gate turn-on delay time	t_{gd}	$T_{vj} = 25\text{ °C}$, $V_D = 0.4 \cdot V_{RM}$, $I_{FG} = 2\text{ A}$, $t_r = 0.5\text{ }\mu\text{s}$			3	μs
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Triggering

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Peak forward gate voltage	V_{FGM}				12	V
Max. rated peak forward gate current	I_{FGM}				10	A
Peak reverse gate voltage	V_{RGM}				10	V
Max. rated gate power loss	P_G	For DC gate current			3	W
Max. rated peak forward gate power	$P_{GM(AV)}$		see Fig. 9			W

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Gate trigger voltage	V_{GT}	$T_{vj} = 25\text{ °C}$			2.6	V
Gate trigger current	I_{GT}	$T_{vj} = 25\text{ °C}$			400	mA
Gate non-trigger voltage	V_{GD}	$V_D = 0.4 \times V_{RM}$, $T_{vj} = 125\text{ °C}$	0.3			V
Gate non-trigger current	I_{GD}	$V_D = 0.4 \times V_{RM}$	10			mA

Thermal

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Operating junction temperature range	T_{vj}				125	°C
Storage temperature range	T_{stg}		-40		140	°C

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Thermal resistance junction to case (Valid for one thyristor half no heat flow to the second half.)	$R_{th(j-c)}$	Double-side cooled $F_m = 81...108\text{ kN}$			11.4	K/kW
	$R_{th(j-c)}$	Single-side cooled $F_m = 81...108\text{ kN}$			22.8	K/kW
Thermal resistance case to heatsink	$R_{th(c-h)}$	Double-side cooled $F_m = 81...108\text{ kN}$			2	K/kW
	$R_{th(c-h)}$	Single-side cooled $F_m = 81...108\text{ kN}$			4	K/kW

Analytical function for transient thermal impedance:

n

i	1	2	3	4
$R_i(K/kW)$	6.770	2.510	1.340	0.780
$\tau_i(s)$	0.8651	0.1558	0.0212	0.0075

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

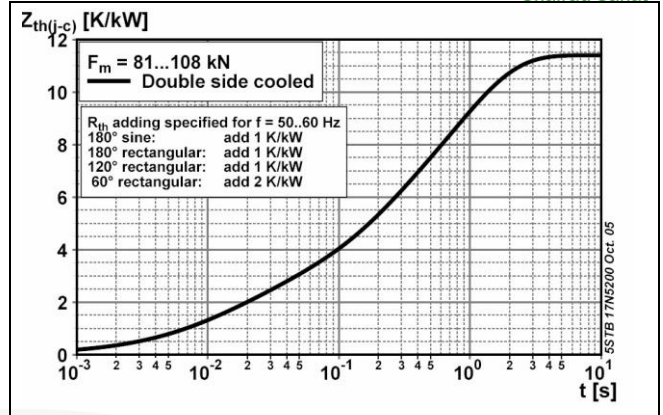


Fig. 1 Transient thermal impedance (junction-to-case) vs. time

On-state characteristic model:

$$V = A + B \cdot IT + C \cdot \ln(IT + 1) + D \cdot IT T_{jmax}$$

Valid for $i_T = 500 - 4000$ A

A	B	C	D
1.309	80.0×10^{-6}	-125.0×10^{-3}	26.0×10^{-3}

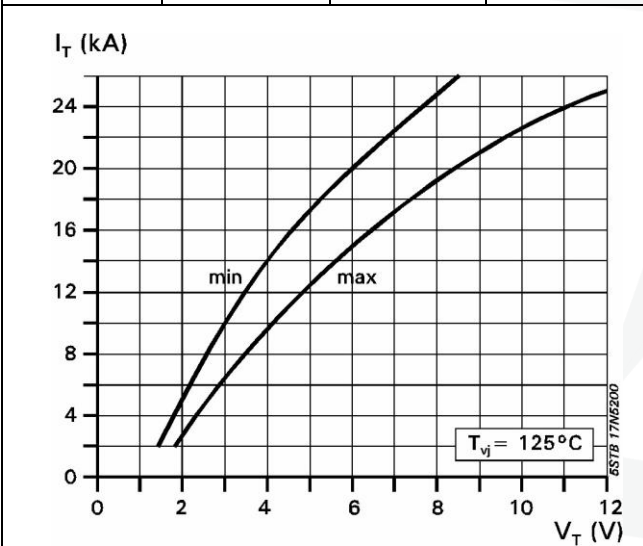


Fig. 2 On-state characteristics, $T_j = 125^\circ C$, 10ms half sine

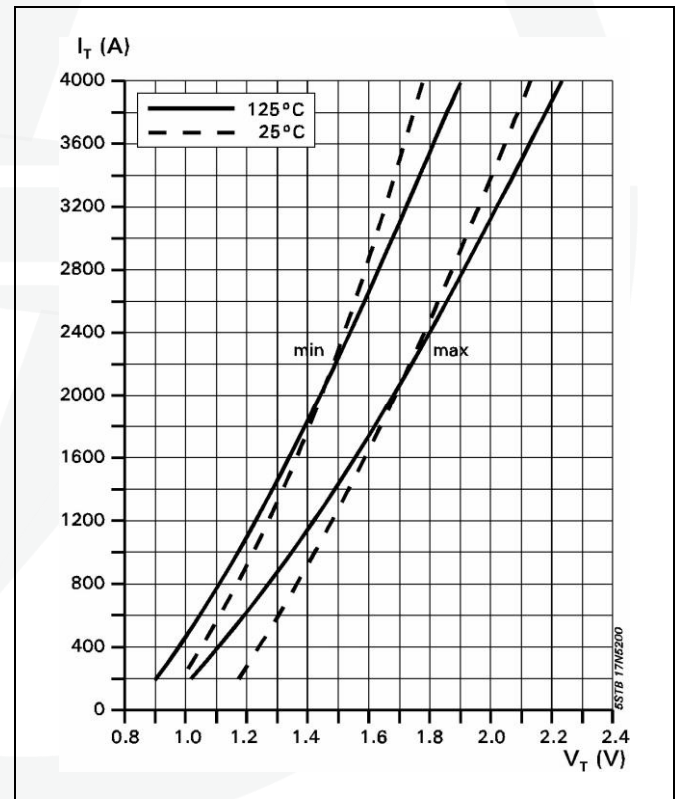


Fig. 3 On-state voltage characteristics

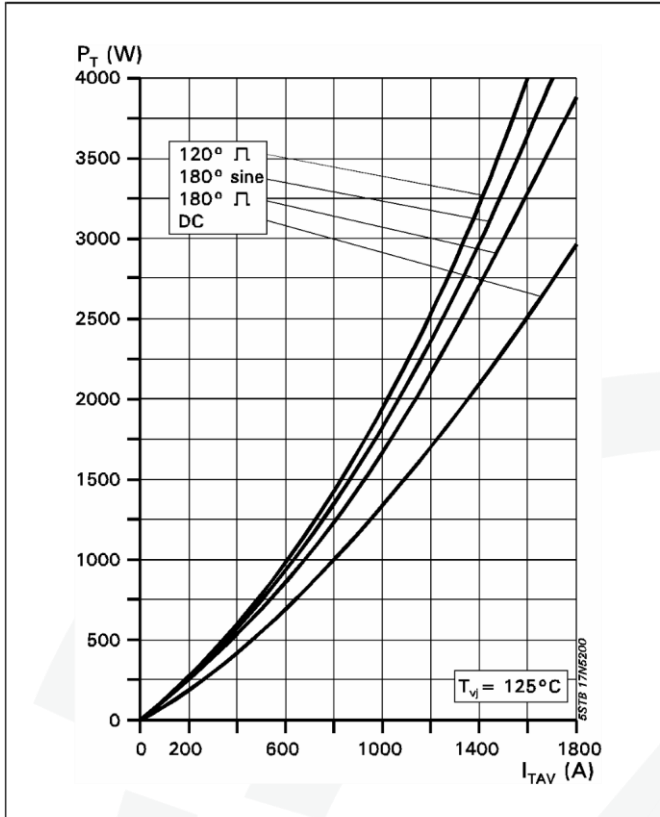


Fig. 4 On-state power dissipation vs. mean on-state current. Turn-on losses excluded.

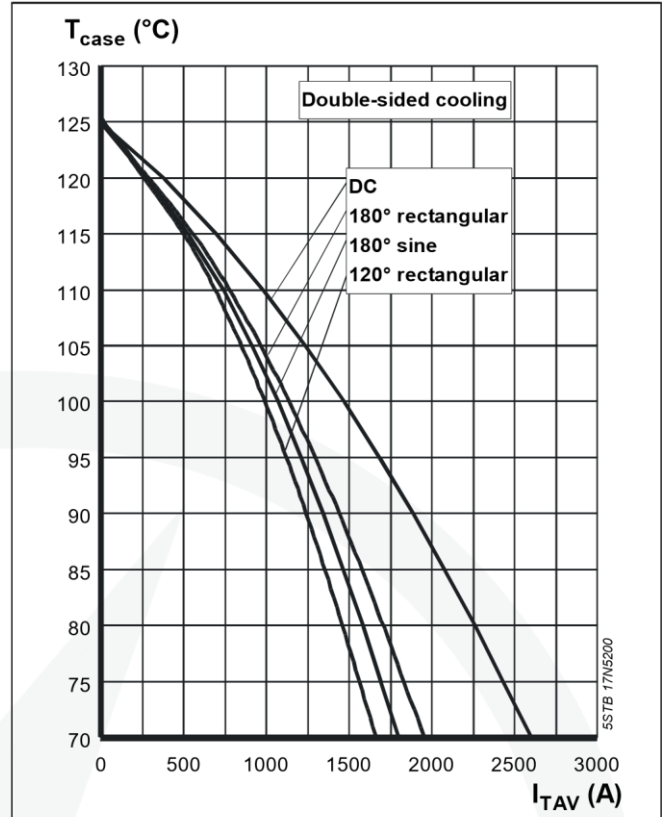


Fig. 5 Max. permissible case temperature vs. mean on-state current. Switching losses ignored.

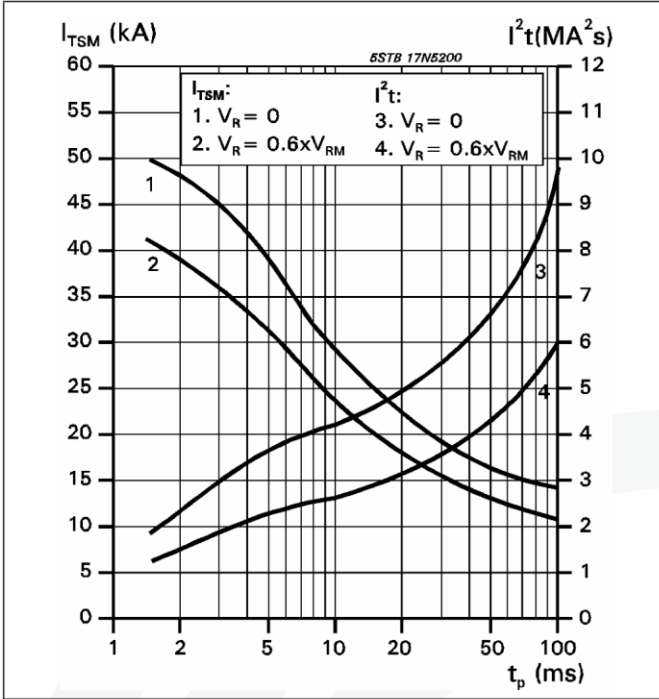


Fig. 6 Surge on-state current vs. pulse length. Half-sine wave.

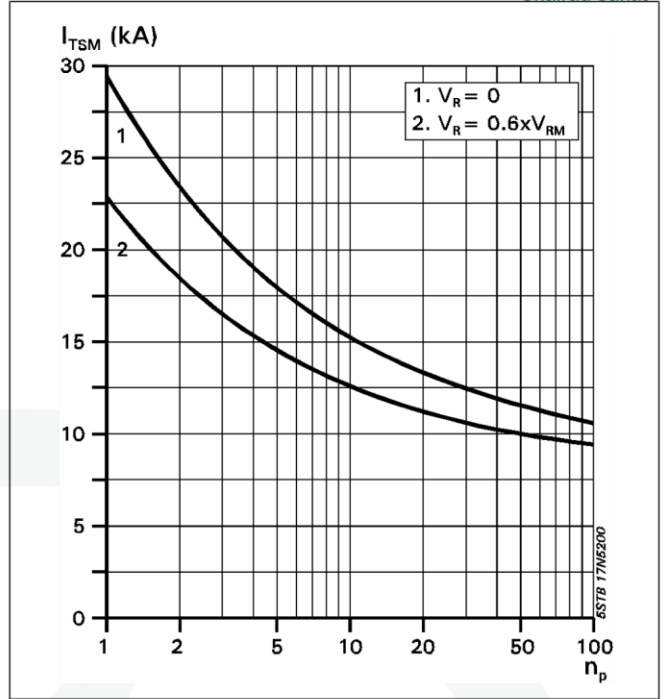


Fig. 7 Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.

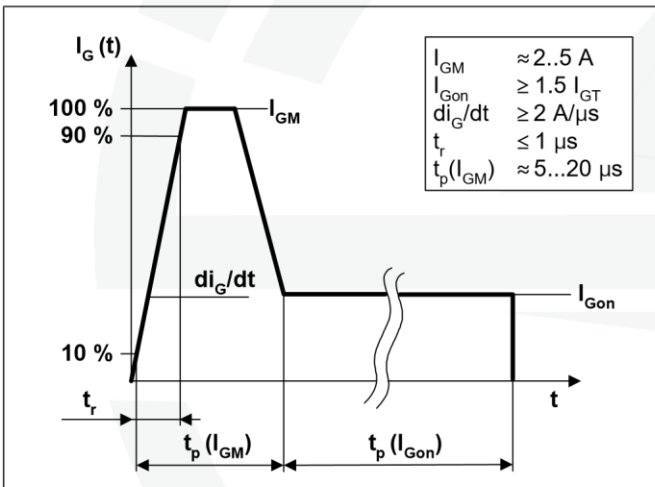


Fig. 8 Recommended gate current waveform

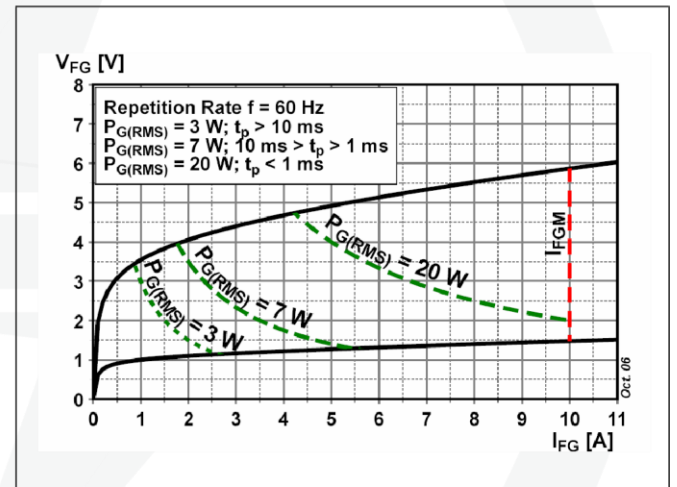


Fig. 9 Max. peak gate power loss

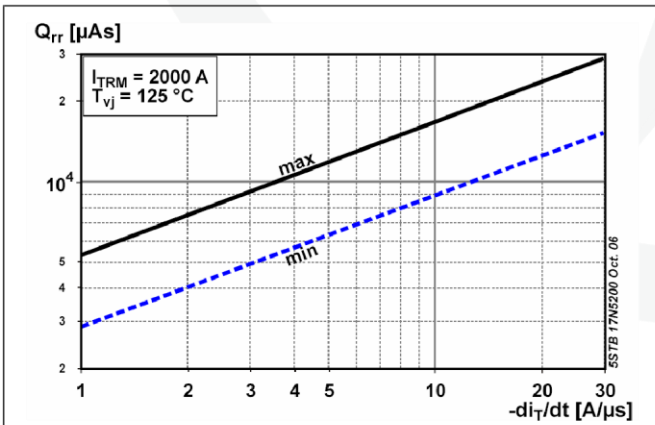


Fig. 10 Reverse recovery charge vs. decay rate of on-state current

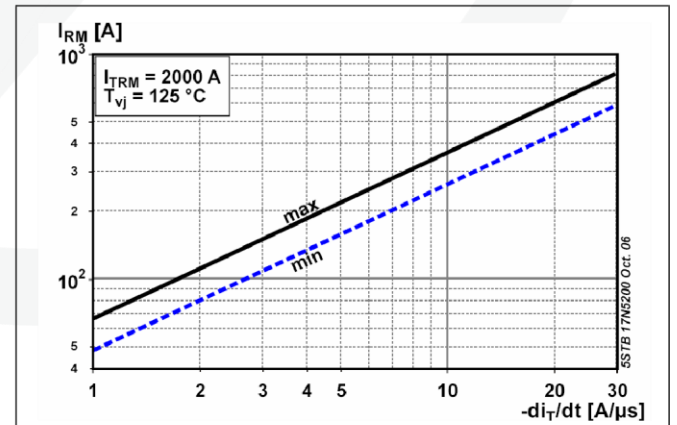


Fig. 11 Peak reverse recovery current vs. decay rate of on-state current

Turn-on and Turn-off losses

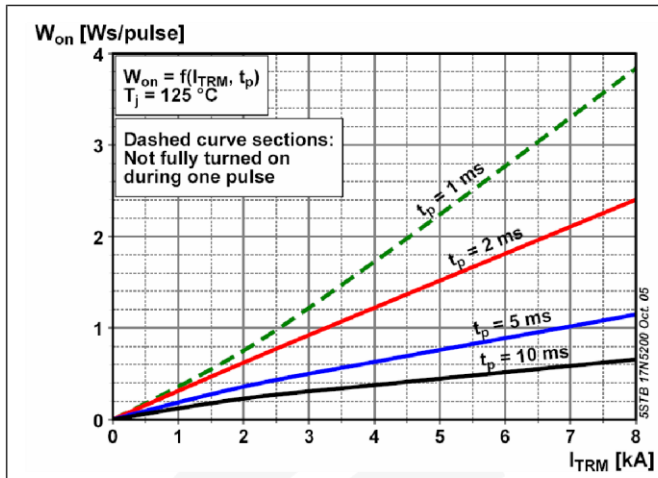


Fig. 12 Turn-on energy, half sinusoidal waves

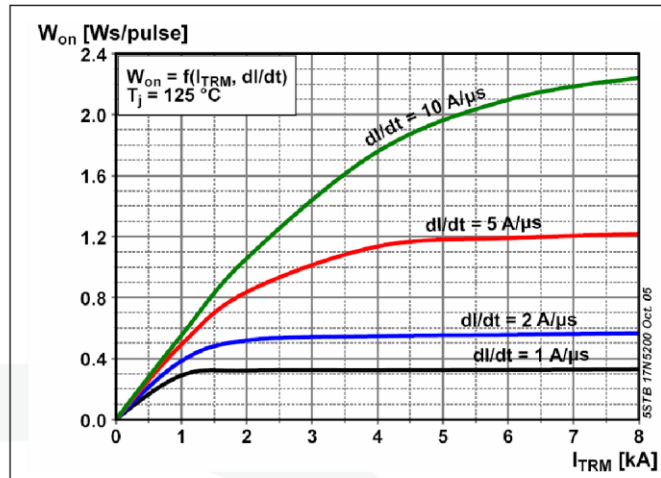


Fig. 13 Turn-on energy, rectangular waves

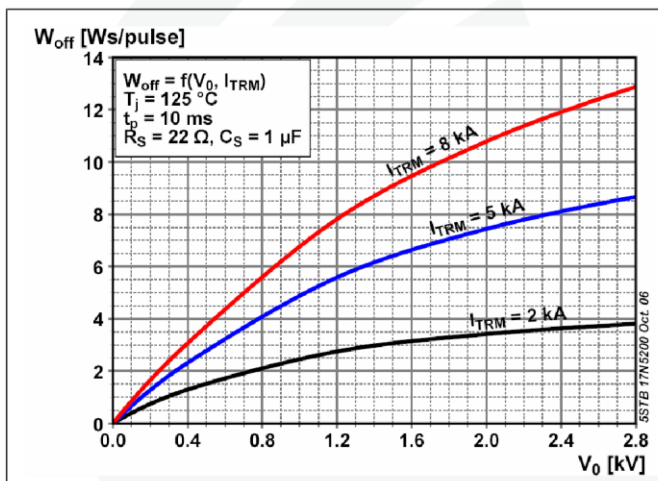


Fig. 14 Turn-off energy, half sinusoidal waves

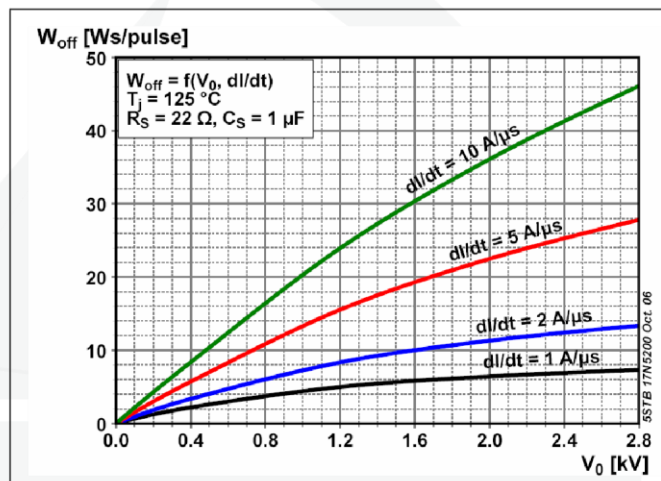


Fig. 15 Turn-off energy, rectangular waves

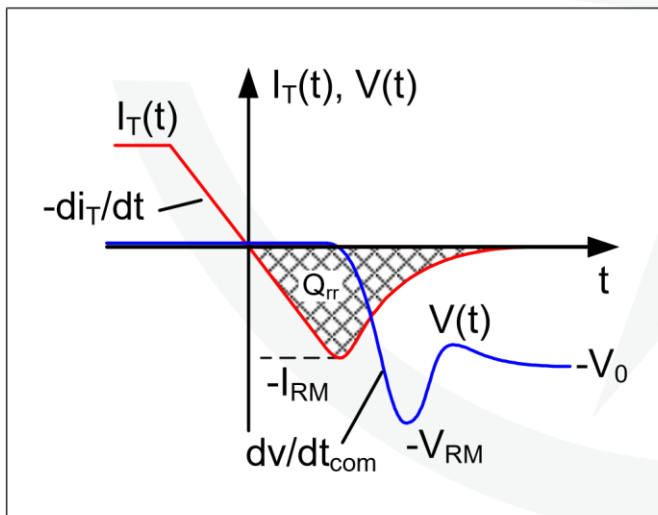


Fig. 16 Current and voltage waveforms at turn-off

Total power loss for repetitive waveforms:

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

where

$$P_T = \frac{1}{T} \int_0^T I_T \cdot V_T(I_T) dt$$

Fig. 17 Relationships for power loss

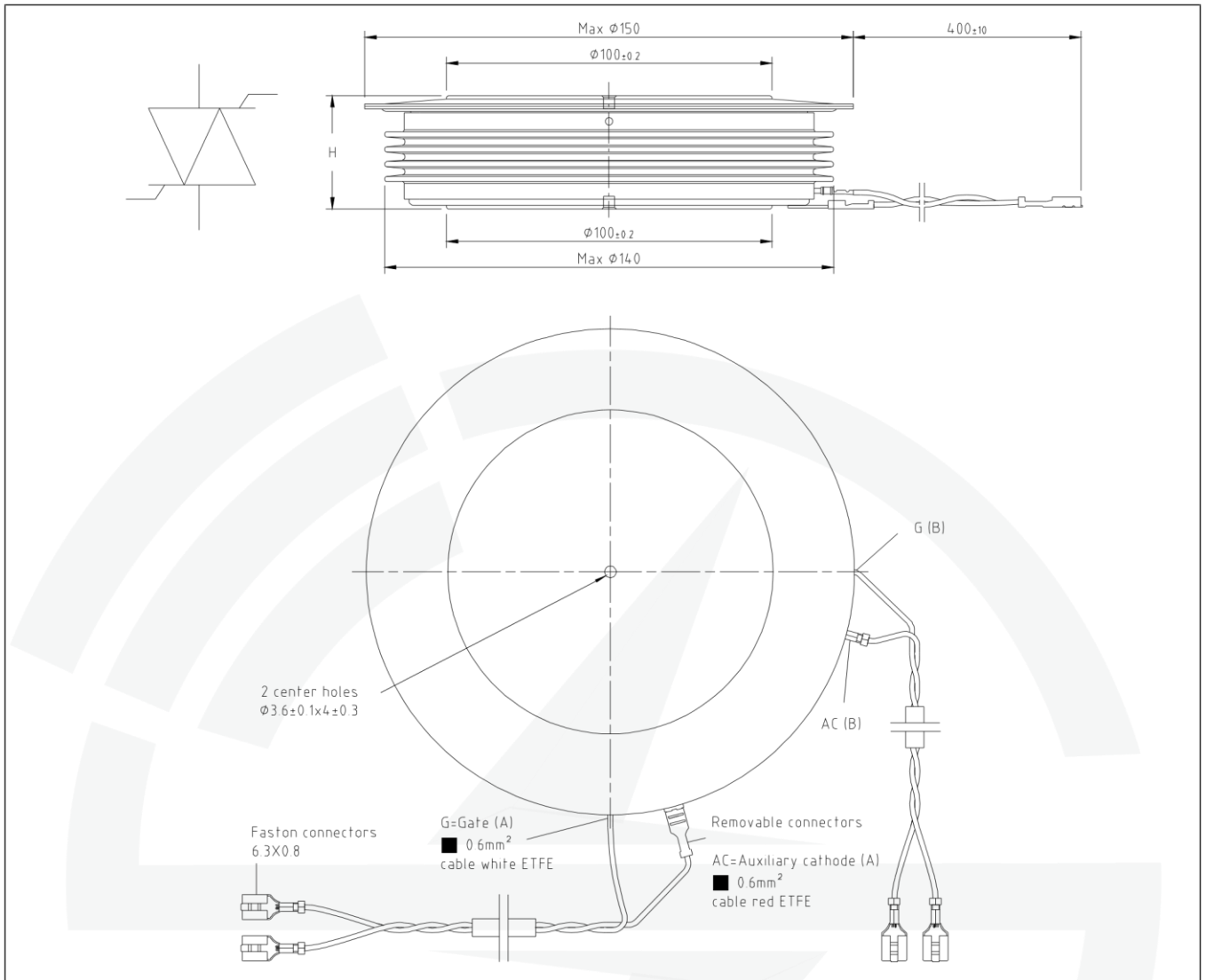


Fig. 18 Device Outline Drawing