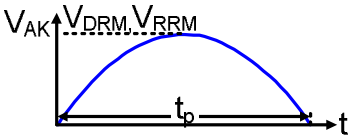|		
V_{DRM}	=	4200 V
$I_{T(AV)M}$	=	1150 A
$I_{T(RMS)}$	=	1800 A
I_{TSM}	=	$17.3 \cdot 10^3$ A
V_{T0}	=	0.95 V
r_T	=	0.575 mΩ

Phase Control Thyristor

5STP 12F4200

- **Patented free-floating silicon technology**
- **Low on-state and switching losses**
- **Designed for traction, energy and industrial applications**
- **Optimum power handling capability**

Blocking
Maximum rated values [1]

Parameter	Symbol	Conditions	5STP 12F4200	Unit
Max repetitive peak forward and reverse blocking voltage	V_{DRM}, V_{RRM}	f = 50 Hz, t_p = 10 ms, T_{vj} = 5…125 °C, Note 1 	4200	V
Critical rate of rise of commutating voltage	dv/dt_{crit}	Exp. to $0.67 \cdot V_{DRM}$, T_{vj} = 125 °C	1000	V/µs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Forward leakage current	I_{DRM}	V_{DRM}, T_{vj} = 125 °C			200	mA
Reverse leakage current	I_{RRM}	V_{RRM}, T_{vj} = 125 °C			200	mA

Note 1: Voltage de-rating factor of 0.11% per °C is applicable for T_{vj} below +5 °C.

Mechanical data
Maximum rated values [1]

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	F_M		14	22	24	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
Weight	m				0.6	kg
Housing thickness	H	F_M = 22 kN, T_a = 25 °C	26.1		26.5	mm
Surface creepage distance	D_S		25			mm
Air strike distance	D_a		14			mm

1) Maximum rated values indicate limits beyond which damage to the device may occur

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On-state

Maximum rated values [1]

Parameter	Symbol	Conditions	min	typ	max	Unit
Average on-state current	$I_{T(AV)M}$	Half sine wave, Tc = 70 °C			1150	A
RMS on-state current	$I_{T(RMS)}$				1800	A
Peak non-repetitive surge current	I_{TSM}	t_p = 10 ms, T_{vj} = 125 °C, sine half wave,			$17.3 \cdot 10^3$	A
Limiting load integral	I^2t	V_D = V_R= 0 V, after surge			$1.5 \cdot 10^6$	A^2s
Peak non-repetitive surge current	I_{TSM}	t_p = 10 ms, T_{vj} = 125 °C, sine half wave,			$12 \cdot 10^3$	A
Limiting load integral	I^2t	V_R = 0.6·V_{RRM}, after surge			$720 \cdot 10^3$	A^2s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_T	I_T = 2000 A, T_{vj} = 125 °C			2.1	V
Threshold voltage	$V_{(T0)}$	I_T = 600 A - 1800 A, T_{vj} = 125 °C			0.95	V
Slope resistance	r_T				0.575	mΩ
Holding current	I_H	Tvj = 25 °C			80	mA
		Tvj = 125 °C			60	mA
Latching current	I_L	Tvj = 25 °C			500	mA
		Tvj = 125 °C			200	mA

Switching

Maximum rated values [1]

Parameter	Symbol	Conditions		min	typ	max	Unit
Critical rate of rise of on-state current	di/dt_{crit}	T_{vj} = 125 °C, I_{TRM} = 2000 A, $V_D \le$ 0.67·V_{DRM}, I_{FG} = 2 A, t_r = 0.5 µs	Cont. f = 50 Hz			100	A/µs
			Cont. f = 1 Hz			1000	A/µs
Circuit-commutated turn-off time	t_q	T_{vj} = 125 °C, I_{TRM} = 2000 A, V_R = 200 V, di_T/dt = -1.5 A/µs, $V_D \le$ 0.67·V_{DRM}, dv_D/dt = 20 V/µs				900	µs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Reverse recovery charge	Q_{rr}	T_{vj} = 125 °C, I_{TRM} = 2000 A, V_R = 200 V, di_T/dt = -1.5 A/µs	1400		2400	µAs
Reverse recovery current	I_{RM}		40		54	A
Gate turn-on delay time	t_{gd}	T_{vj} = 25 °C, V_D = 0.4·V_{RM}, I_{FG} = 2 A, t_r = 0.5 µs			2	µs

Triggering

Maximum rated values [1]

Parameter	Symbol	Conditions	min	typ	max	Unit
Peak forward gate voltage	V_{FGM}				12	V
Peak forward gate current	I_{FGM}				10	A
Peak reverse gate voltage	V_{RGM}				10	V
Average gate power loss	$P_{G(AV)}$			see Fig. 7		W

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Gate-trigger voltage	V_{GT}	Tvj = 25 °C			2.6	V
Gate-trigger current	I_{GT}	Tvj = 25 °C			400	mA
Gate non-trigger voltage	V_{GD}	$V_D = 0.4 \cdot V_{DRM}$, T_{vjmax} = 125 °C			0.3	V
Gate non-trigger current	I_{GD}	$V_D = 0.4 \cdot V_{DRM}$, T_{vjmax} = 125 °C			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,	$R_{th(j-c)}$	Double-side cooled F_m = 14... 24 kN			17	K/kW
	$R_{th(j-c)A}$	Anode-side cooled F_m = 14... 24 kN			33	K/kW
	$R_{th(j-c)C}$	Cathode-side cooled F_m = 14... 24 kN			35	K/kW
Thermal resistance case to heatsink,	$R_{th(c-h)}$	Double-side cooled F_m = 14... 24 kN			4	K/kW
	$R_{th(c-h)}$	Single-side cooled F_m = 14... 24 kN			8	K/kW

Analytical function for transient thermal impedance:

$$Z_{th(j-c)}(t) = \sum_{i=1}^{n} R_i \left(1 - e^{-t/\tau_i}\right)$$

i	1	2	3	4
R_i(K/kW)	10.350	3.760	2.290	0.670
τ_i(s)	0.3723	0.0525	0.0057	0.0023
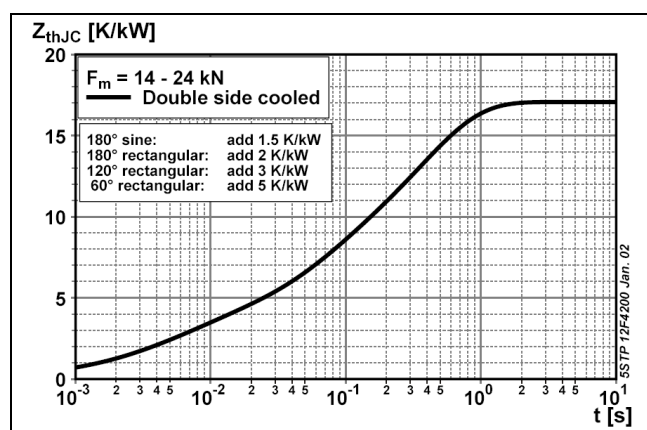
Fig. 1 Transient thermal impedance (junction-to-case) vs. time

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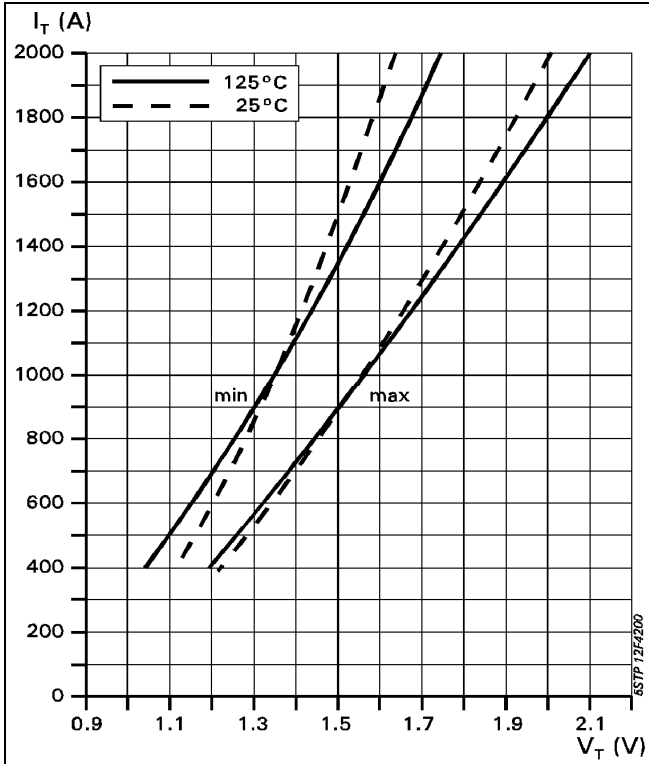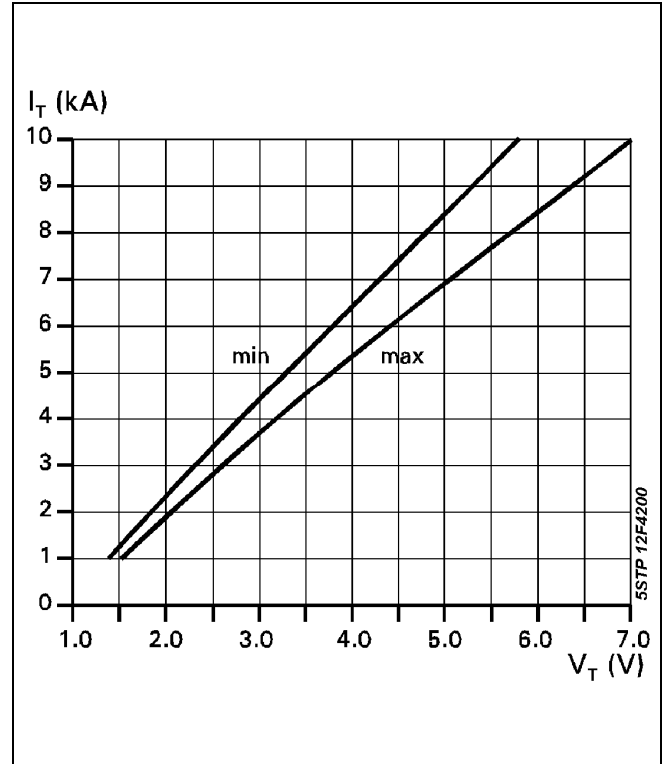
Fig. 2 On-state voltage characteristics

Fig. 3 On-state voltage characteristics
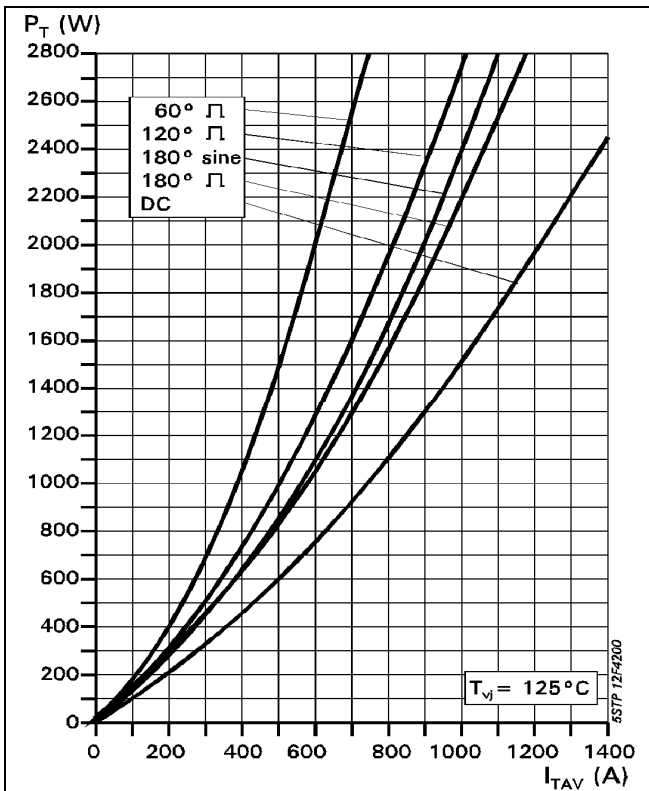T_{vj} = 125 °C, 10 ms half sine

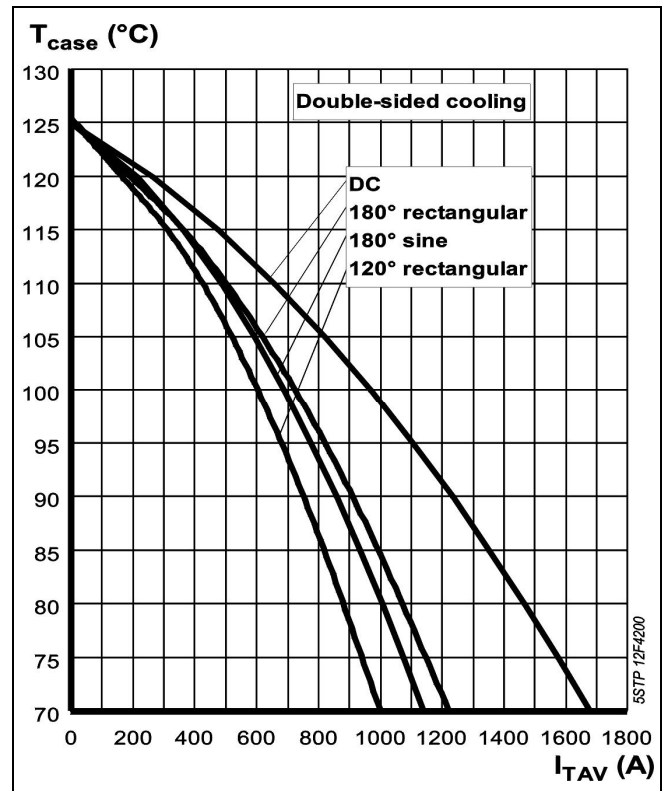**Fig. 4** On-state power dissipation vs. mean on-state current, turn-on losses excluded

Fig. 5 Max. permissible case temperature vs. mean on-state current, switching losses ignored
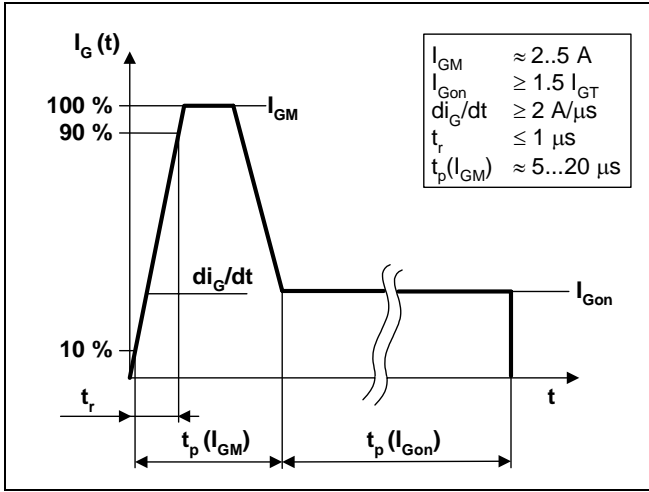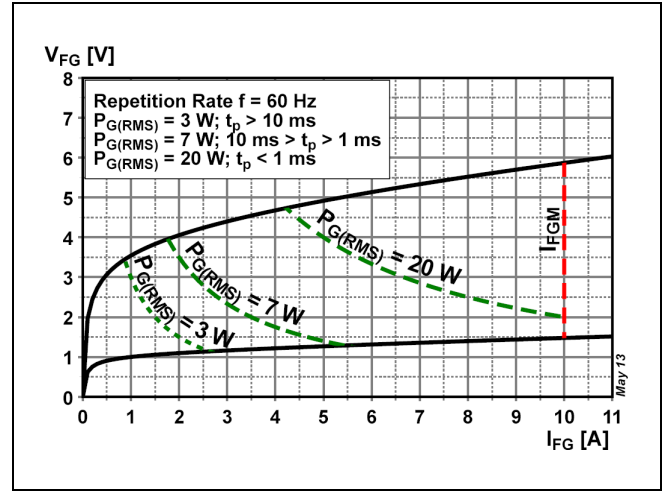
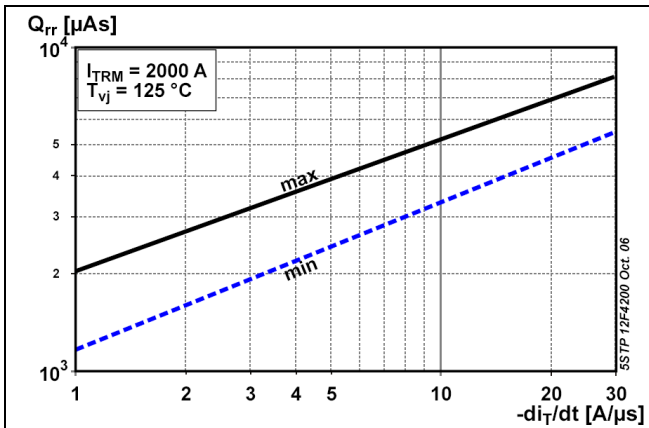**Fig. 6** Recommended gate current waveform

Fig. 7 Max. peak gate power loss

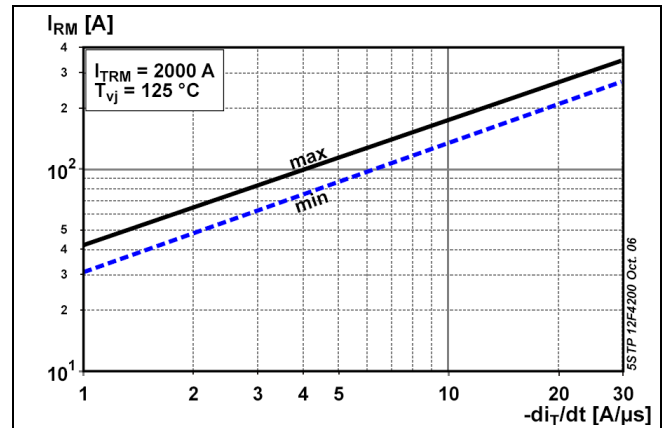**Fig. 8** Reverse recovery charge vs. decay rate of on-state current

Fig. 9 Peak reverse recovery current vs. decay rate of on-state current

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Turn-on and Turn-off losses
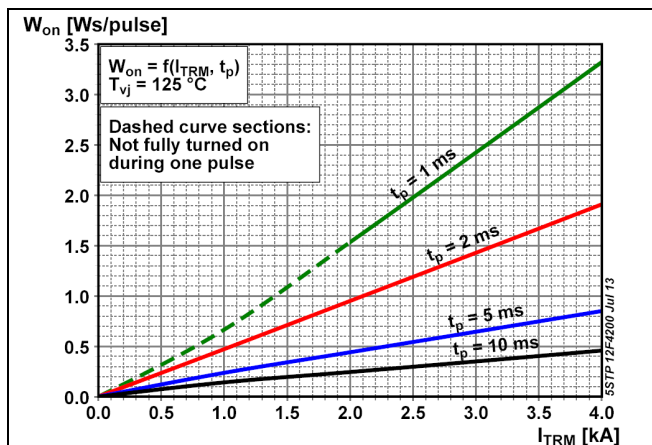
Fig. 10 Turn-on energy, half sinusoidal waves
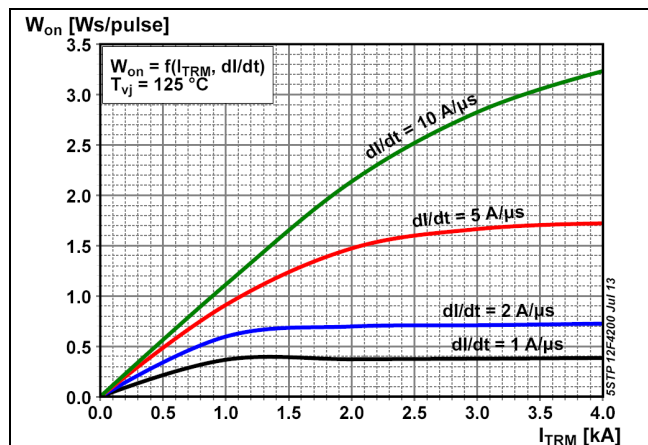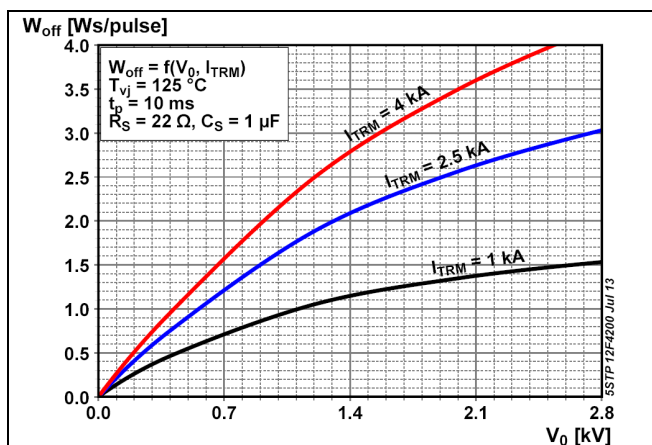

Fig. 11 Turn-on energy, rectangular waves

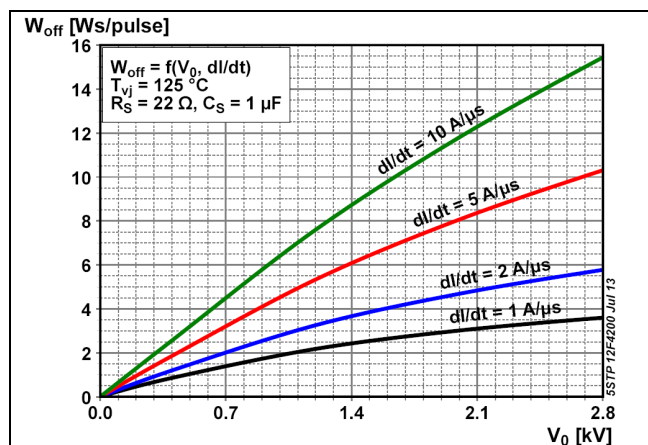**Fig. 12** Turn-off energy, half sinusoidal waves

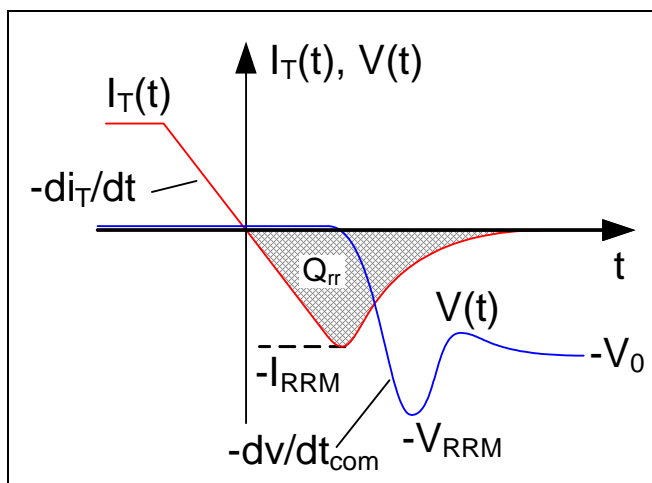**Fig. 13** Turn-off energy, rectangular waves

Fig. 14 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

$$P_T = \frac{1}{T} \int_0^T I_T \cdot V_T(I_T) \ dt$$
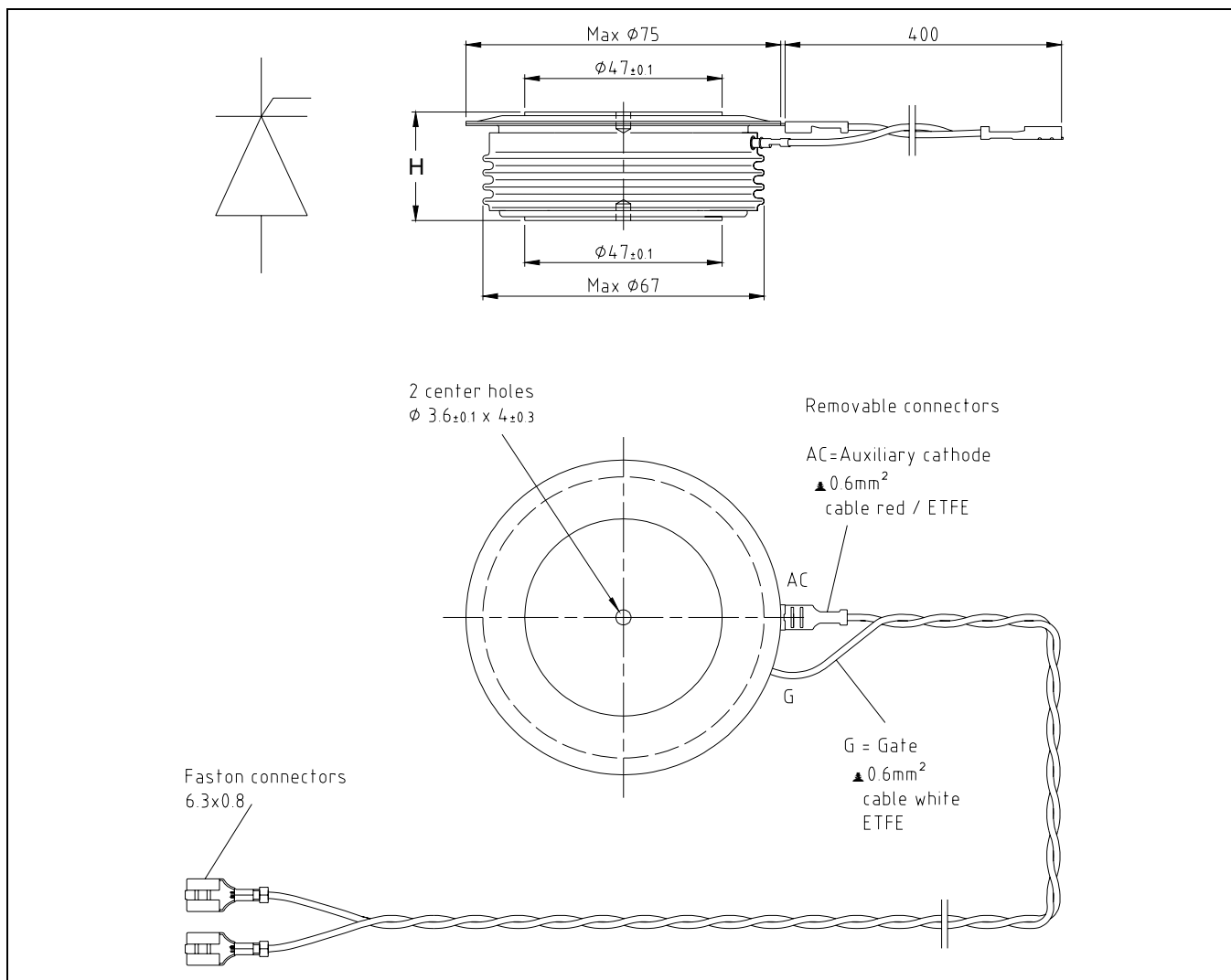
Fig. 15 Relationships for power loss

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Fig. 16 Device Outline Drawing

Related documents:

5SYA 2020	Design of RC-Snubber for Phase Control Applications
5SYA 2049	Voltage definitions for phase control thyristors and diodes
5SYA 2051	Voltage ratings of high power semiconductors
5SYA 2034	Gate-Drive Recommendations for PCT's
5SYA 2036	Recommendations regarding mechanical clamping of Press Pack High Power Semiconductors
5SZK 9104	Specification of environmental class for pressure contact diodes, PCTs and GTO, STORAGE available on request, please contact factory
5SZK 9105	Specification of environmental class for pressure contact diodes, PCTs and GTO, TRANSPORTATION available on request, please contact factory

Please refer to http://www.abb.com/semiconductors for current version of documents.