

V_{DSM}	=	4200 V
I_{TAVM}	=	1150 A
I_{TRMS}	=	1800 A
I_{TSM}	=	15000 A
V_{T0}	=	0.95 V
r_T	=	0.575 m Ω

Phase Control Thyristor

5STP 12F4200

Doc. No. 5SYA1021-03 Jan. 02

- 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⁾

Symbol	Conditions	5STP 12F4200	5STP 12F4000	5STP 12F3600
V_{DRM}, V_{RRM}	f = 50 Hz, $t_p = 10$ ms	4200 V	4000 V	3600 V
V_{RSM}	$t_p = 5$ ms, single pulse	4600 V	4400 V	4000 V
dV/dt_{crit}	Exp. to $0.67 \times V_{DRM}, T_{vj} = 125^\circ\text{C}$	1000 V/ μs		

Characteristic values

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

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
Surface creepage distance	D_s		25			mm
Air strike distance	D_a		14			mm

¹⁾ Maximum ratings are those values 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_{TAVM}	Half sine wave, $T_c = 70^\circ\text{C}$			1150	A
RMS on-state current	I_{TRMS}				1800	A
Peak non-repetitive surge current	I_{TSM}	$t_p = 10\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, $V_D = V_R = 0\text{ V}$			15000	A
Limiting load integral	I^2t				1125	kA^2s
Peak non-repetitive surge current	I_{TSM}	$t_p = 8.3\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, $V_D = V_R = 0\text{ V}$			16000	A
Limiting load integral	I^2t				1062	kA^2s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_T	$I_T = 2000\text{ A}$, $T_{vj} = 125^\circ\text{C}$			2.1	V
Threshold voltage	V_{T0}	$I_T = 600\text{ A} - 1800\text{ A}$, $T_{vj} = 125^\circ\text{C}$			0.95	V
Slope resistance	r_T				0.575	$\text{m}\Omega$
Holding current	I_H	$T_{vj} = 25^\circ\text{C}$			80	mA
		$T_{vj} = 125^\circ\text{C}$			60	mA
Latching current	I_L	$T_{vj} = 25^\circ\text{C}$			500	mA
		$T_{vj} = 125^\circ\text{C}$			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}	$T_{vj} = 125^\circ\text{C}$, $I_{TRM} = 2000\text{ A}$, $V_D \leq 0.67 \cdot V_{DRM}$, $I_{FG} = 2\text{ A}$, $t_r = 0.5\text{ }\mu\text{s}$			100	$\text{A}/\mu\text{s}$
Critical rate of rise of on-state current	di/dt_{crit}		Cont. $f = 50\text{ Hz}$			1000
Circuit-commutated turn-off time	t_q	$T_{vj} = 125^\circ\text{C}$, $I_{TRM} = 2000\text{ A}$, $V_R = 200\text{ V}$, $di_T/dt = -5\text{ A}/\mu\text{s}$, $V_D \leq 0.67 \cdot V_{DRM}$, $dV_D/dt = 20\text{ V}/\mu\text{s}$,	600			μs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Recovery charge	Q_{rr}	$T_{vj} = 125^\circ\text{C}$, $I_{TRM} = 2000\text{ A}$, $V_R = 200\text{ V}$, $di_T/dt = -5\text{ A}/\mu\text{s}$	2500		4000	μAs
Delay time	t_d	$V_D = 0.4 \cdot V_{DRM}$, $I_{FG} = 2\text{ A}$, $t_r = 0.5\text{ }\mu\text{s}$			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
Gate power loss	P _G	For DC gate current			3	W
Average gate power loss	P _{GAV}		see Fig. 9			

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Gate trigger voltage	V _{GT}	T _{vj} = 25°C			2.6	V
Gate trigger current	I _{GT}	T _{vj} = 25°C			400	mA
Gate non-trigger voltage	V _{GD}	V _D = 0.4 x V _{DRM} , T _{vjmax} = 125°C	0.3			V
Gate non-trigger current	I _{GD}	V _D = 0.4 x 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			17	K/kW
	R _{th(j-c)A}	Anode-side cooled			33	K/kW
	R _{th(j-c)C}	Cathode-side cooled			35	K/kW
Thermal resistance case to heatsink	R _{th(c-h)}	Double-side cooled			4	K/kW
	R _{th(c-h)}	Single-side cooled			8	K/kW

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)	10.35	3.76	2.29	0.67
τ _i (s)	0.3723	0.0525	0.0057	0.0023

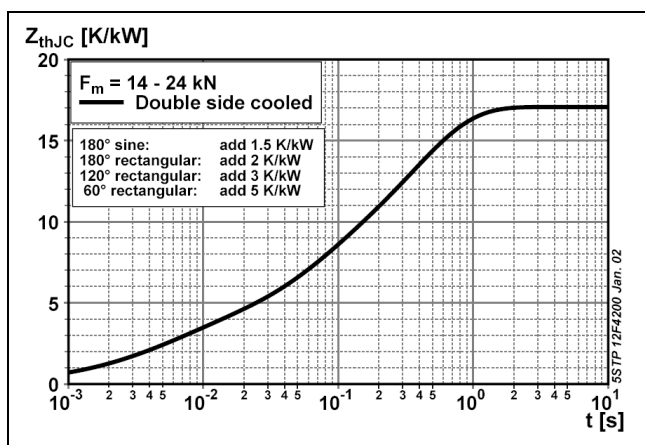


Fig. 1 Transient thermal impedance junction-to case.

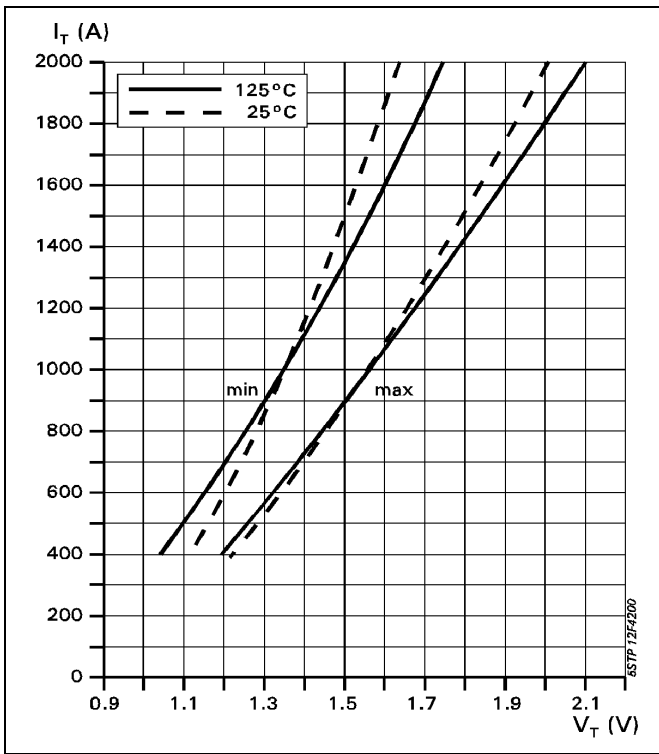


Fig. 2 On-state characteristics.

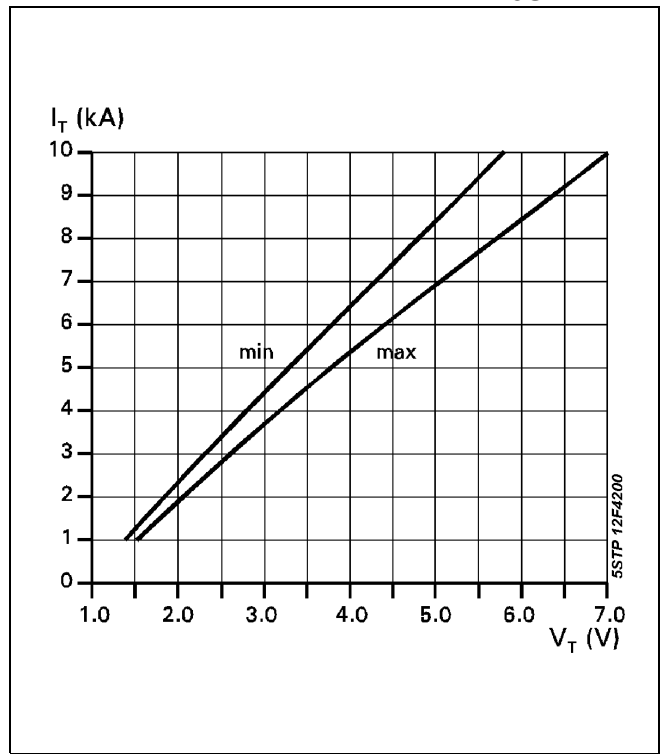


Fig. 3 On-state characteristics.
T_j=125°C, 10ms half sine

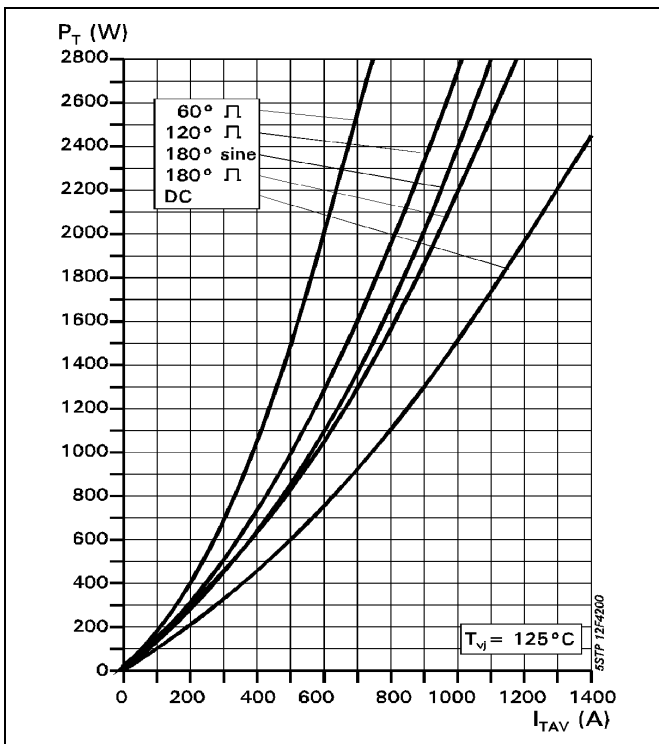


Fig. 4 On-state power dissipation vs. mean on-state current. Turn - on losses excluded.

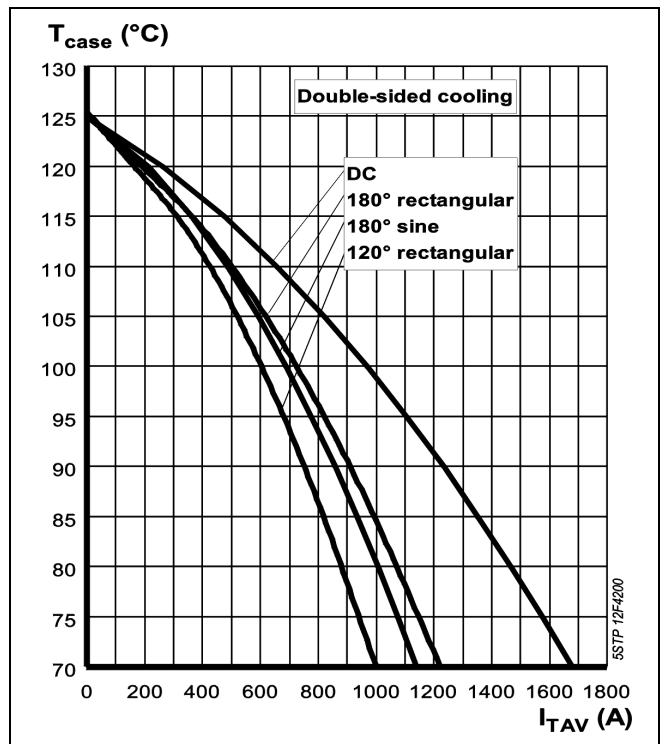


Fig. 5 Max. permissible case temperature vs. mean on-state current.

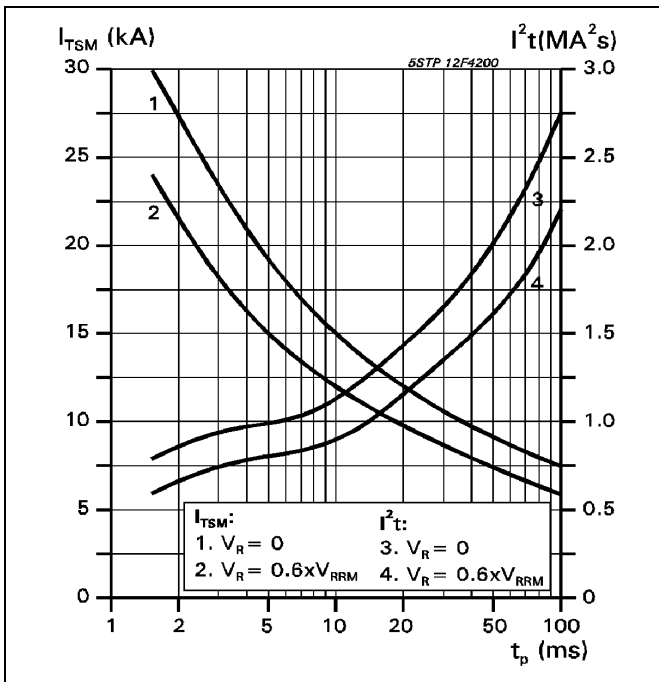


Fig. 6 Surge on-state current vs. pulse length. Half-sine wave.

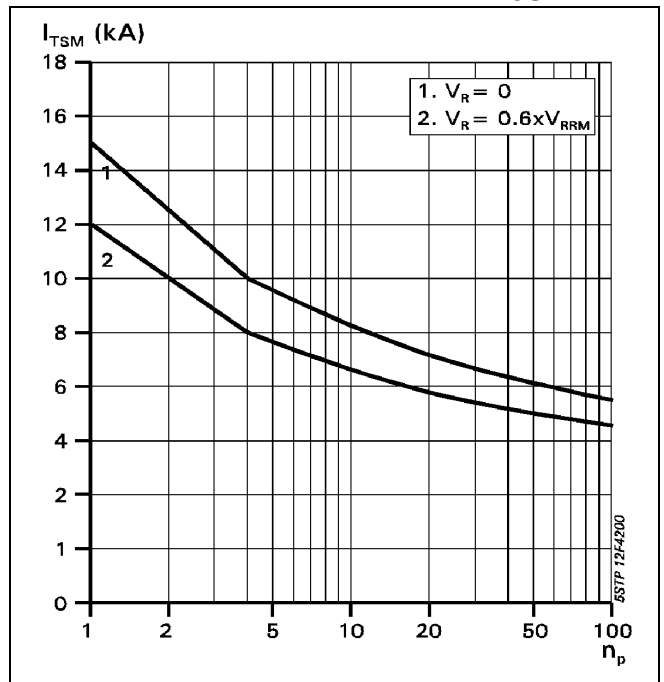


Fig. 7 Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.

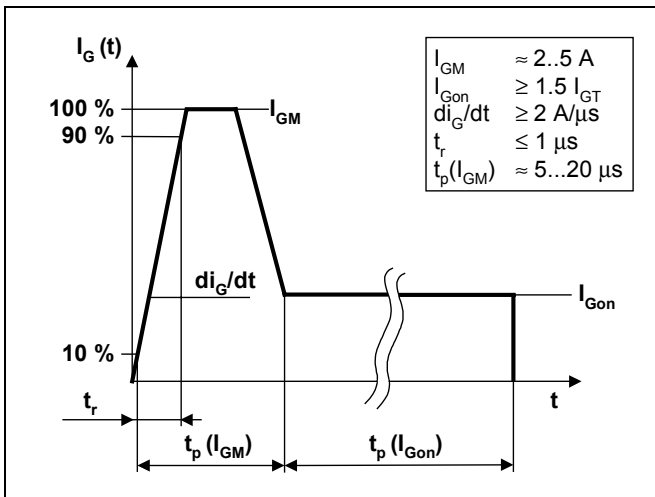


Fig. 8 Recommended gate current waveform.

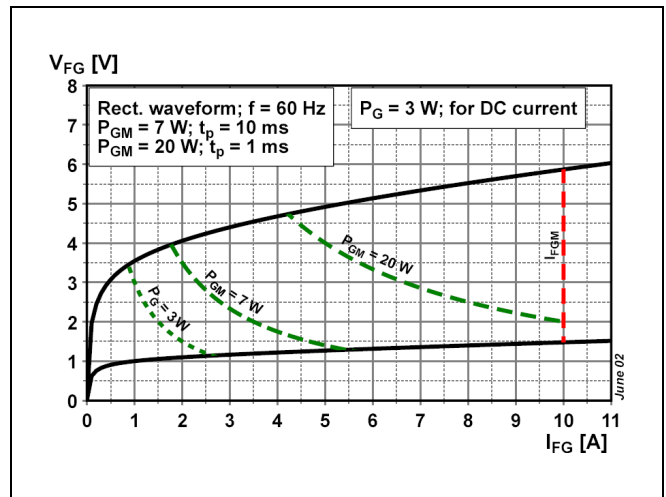


Fig. 9 Max. peak gate power loss.

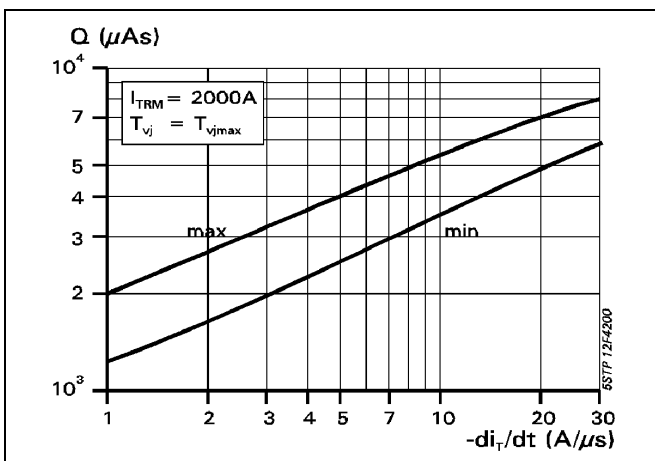


Fig. 10 Recovery charge vs. decay rate of on-state current.

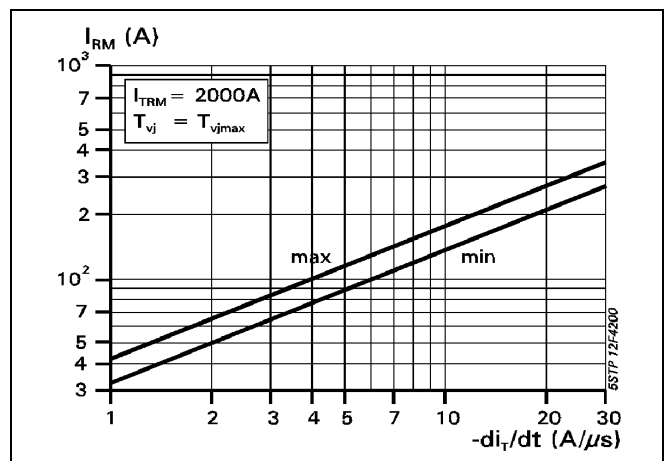


Fig. 11 Peak reverse recovery current vs. decay rate of on-state current.

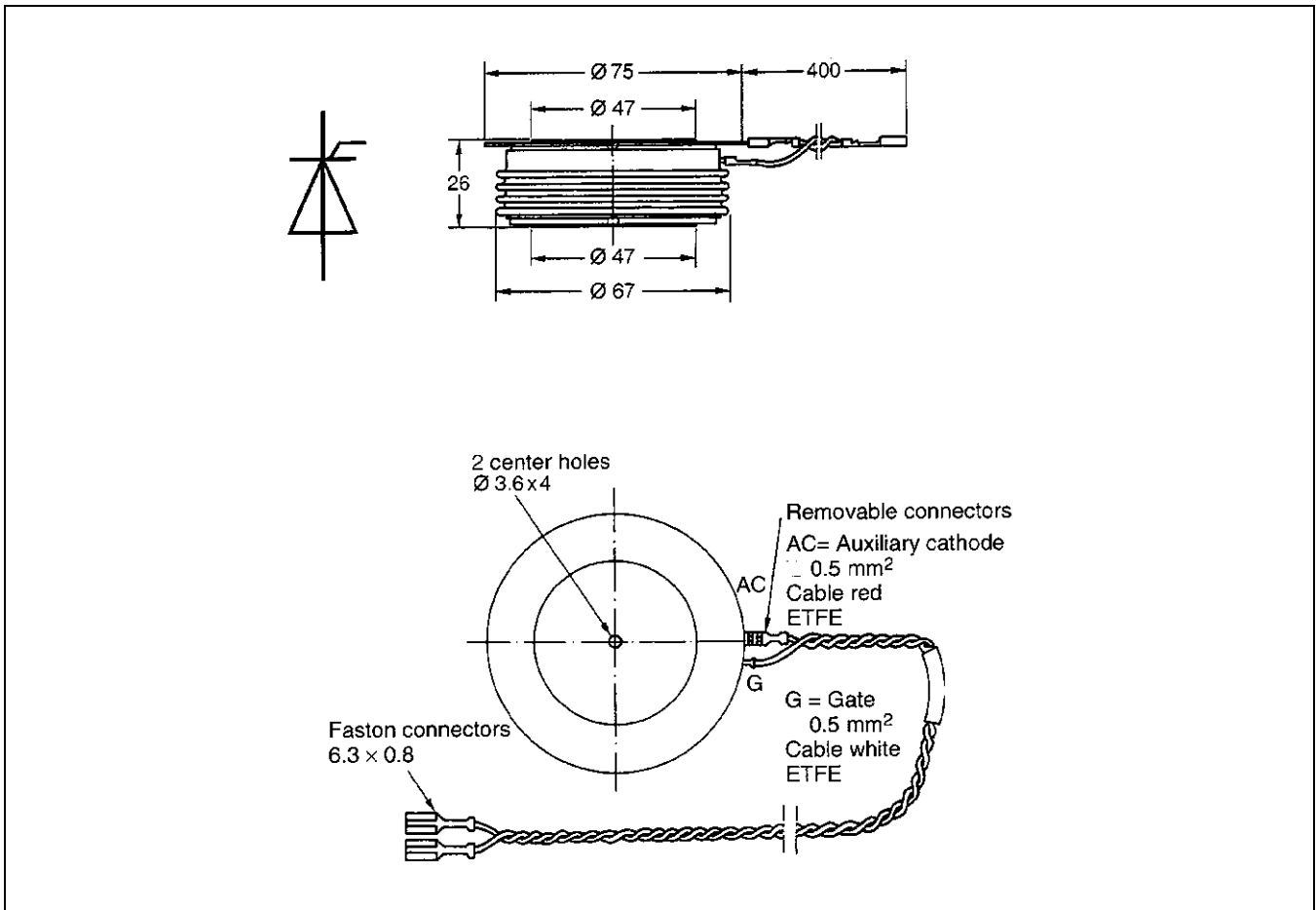


Fig. 12 Device Outline Drawing.

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Doc. No. 5SYA1021-03 Jan. 02

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