

$V_{DRM}$	=	5600 V
$V_{DSM}$	=	6500 V
$I_{T(AV)M}$	=	720 A
$I_{T(RMS)}$	=	1140 A
$I_{TSM}$	=	$11.8 \times 10^3$ A
$V_{(T0)}$	=	1.24 V
$r_T$	=	1.015 m $\Omega$

## Phase Control Thyristor

# 5STP 08G6500

Doc. No. 5SYA1006-03 Apr. 03

- 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 <sup>1)</sup>

Symbol	Conditions	5STP 08G6500	5STP 08G6200	5STP 08G5800
$V_{DSM}, V_{RSM}$	$f = 5$ Hz, $t_p = 10$ ms	6500 V	6200 V	5800 V
$V_{DRM}, V_{RRM}$	$f = 50$ Hz, $t_p = 10$ ms	5600 V	5300 V	4900 V
$V_{RSM}$	$t_p = 5$ ms, single pulse	7000 V	6700 V	6300 V
$dV/dt_{crit}$	Exp. to $0.67 \times V_{DRM}$ , $T_{vj} = 125^\circ\text{C}$	2000 V/ $\mu\text{s}$		

Characteristic values

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

$V_{DRM}/V_{RRM}$  are equal to  $V_{DSM}/V_{RSM}$  values up to  $T_{vj} = 110^\circ\text{C}$

### Mechanical data

Maximum rated values <sup>1)</sup>

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	$F_M$		14	22	24	kN
Acceleration	$a$	Device unclamped			50	$\text{m/s}^2$
Acceleration	$a$	Device clamped			100	$\text{m/s}^2$

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Weight	$m$				0.65	kg
Surface creepage distance	$D_s$		38			mm
Air strike distance	$D_a$		21			mm

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

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**On-state***Maximum rated values <sup>1)</sup>*

Parameter	Symbol	Conditions	min	typ	max	Unit
Average on-state current	$I_{T(AV)M}$	Half sine wave, $T_c = 70^\circ\text{C}$			720	A
RMS on-state current	$I_{T(RMS)}$				1140	A
Peak non-repetitive surge current	$I_{TSM}$	$t_p = 10\text{ ms}$ , $T_{vj} = 125^\circ\text{C}$ , $V_D = V_R = 0\text{ V}$			$11.8 \times 10^3$	A
Limiting load integral	$I^2t$				$703 \times 10^3$	$\text{A}^2\text{s}$
Peak non-repetitive surge current	$I_{TSM}$	$t_p = 8.3\text{ ms}$ , $T_{vj} = 125^\circ\text{C}$ , $V_D = V_R = 0\text{ V}$			$12.76 \times 10^3$	A
Limiting load integral	$I^2t$				$676 \times 10^3$	$\text{A}^2\text{s}$

**Characteristic values**

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	$V_T$	$I_T = 1000\text{ A}$ , $T_{vj} = 125^\circ\text{C}$			2.25	V
Threshold voltage	$V_{(TO)}$	$I_T = 500\text{ A} - 1800\text{ A}$ , $T_{vj} = 125^\circ\text{C}$			1.24	V
Slope resistance	$r_T$				1.015	$\text{m}\Omega$
Holding current	$I_H$	$T_{vj} = 25^\circ\text{C}$			90	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 <sup>1)</sup>*

Parameter	Symbol	Conditions	min	typ	max	Unit
Critical rate of rise of on-state current	$di/dt_{crit}$	$T_{vj} = 125^\circ\text{C}$ , $I_{TRM} = 1300\text{ A}$ , Cont. $f = 50\text{ Hz}$			50	$\text{A}/\mu\text{s}$
Critical rate of rise of on-state current	$di/dt_{crit}$	$V_D \leq 0.67 V_{DRM}$ , $I_{FG} = 2\text{ A}$ , $t_r = 0.5\ \mu\text{s}$ , Cont. $f = 1\text{ Hz}$			1000	$\text{A}/\mu\text{s}$
Circuit-commutated turn-off time	$t_q$	$T_{vj} = 125^\circ\text{C}$ , $I_{TRM} = 2000\text{ A}$ , $V_R = 200\text{ V}$ , $di_T/dt = -1\text{ A}/\mu\text{s}$ , $V_D \leq 0.67 \cdot V_{DRM}$ , $dV_D/dt = 20\text{ V}/\mu\text{s}$ ,	700			$\mu\text{s}$

**Characteristic values**

Parameter	Symbol	Conditions	min	typ	max	Unit
Recovery charge	$Q_{rr}$	$T_{vj} = 125^\circ\text{C}$ , $I_{TRM} = 2000\text{ A}$ , $V_R = 200\text{ V}$ , $di_T/dt = -1\text{ A}/\mu\text{s}$	1600		2700	$\mu\text{As}$
Gate turn-on delay time	$t_{gd}$	$V_D = 0.4 \cdot V_{DRM}$ , $I_{FG} = 2\text{ A}$ , $t_r = 0.5\ \mu\text{s}$ , $T_{vj} = 25^\circ\text{C}$			3	$\mu\text{s}$

## Triggering

Maximum rated values <sup>1)</sup>

Parameter	Symbol	Conditions	min	typ	max	Unit
Peak forward gate voltage	V <sub>FGM</sub>				12	V
Peak forward gate current	I <sub>FGM</sub>				10	A
Peak reverse gate voltage	V <sub>RGM</sub>				10	V
Average gate power loss	P <sub>G(AV)</sub>		see Fig. 9			

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Gate-trigger voltage	V <sub>GT</sub>	T <sub>vj</sub> = 25 °C			2.6	V
Gate-trigger current	I <sub>GT</sub>	T <sub>vj</sub> = 25 °C			400	mA
Gate non-trigger voltage	V <sub>GD</sub>	V <sub>D</sub> = 0.4 x V <sub>DRM</sub> , T <sub>vjmax</sub> = 125 °C	0.3			V
Gate non-trigger current	I <sub>GD</sub>	V <sub>D</sub> = 0.4 x V <sub>DRM</sub> , T <sub>vjmax</sub> = 125 °C	10			mA

## Thermal

Maximum rated values <sup>1)</sup>

Parameter	Symbol	Conditions	min	typ	max	Unit
Operating junction temperature range	T <sub>vj</sub>				125	°C
Storage temperature range	T <sub>stg</sub>		-40		140	°C

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Thermal resistance junction to case	R <sub>th(j-c)</sub>	Double-side cooled			22	K/kW
	R <sub>th(j-c)A</sub>	Anode-side cooled			43	K/kW
	R <sub>th(j-c)C</sub>	Cathode-side cooled			45	K/kW
Thermal resistance case to heatsink	R <sub>th(c-h)</sub>	Double-side cooled			4	K/kW
	R <sub>th(c-h)</sub>	Single-side cooled			8	K/kW

Analytical function for transient thermal impedance:

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

i	1	2	3	4
R <sub>i</sub> (K/kW)	14.267	4.550	1.985	1.202
τ <sub>i</sub> (s)	0.6894	0.0872	0.0217	0.0043

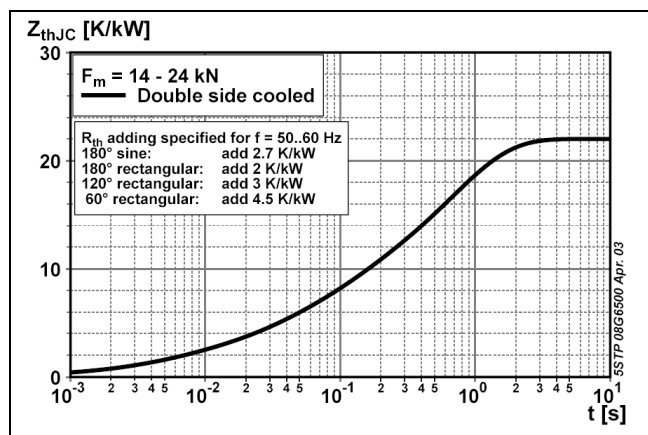
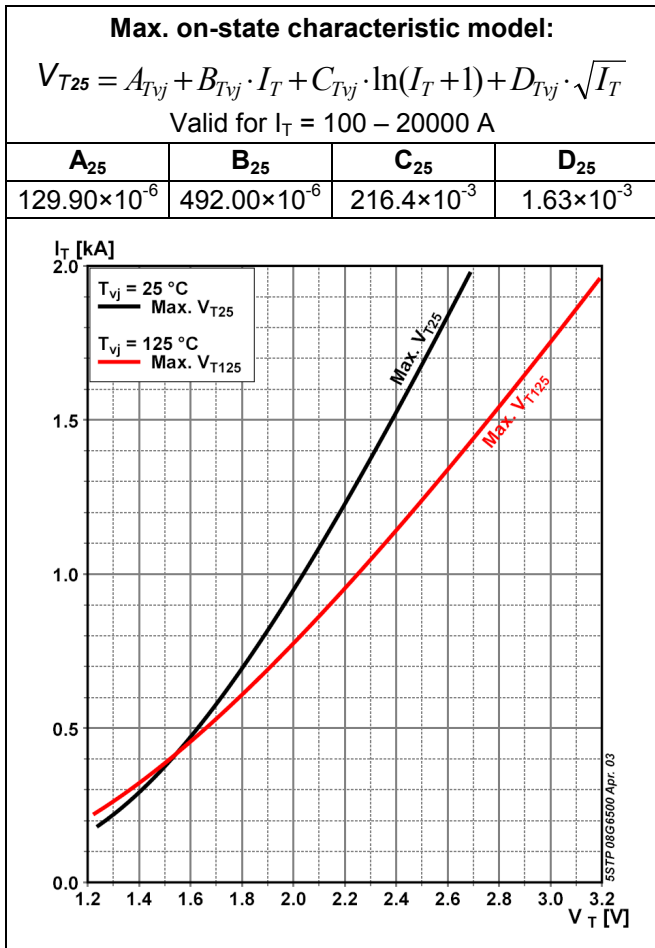
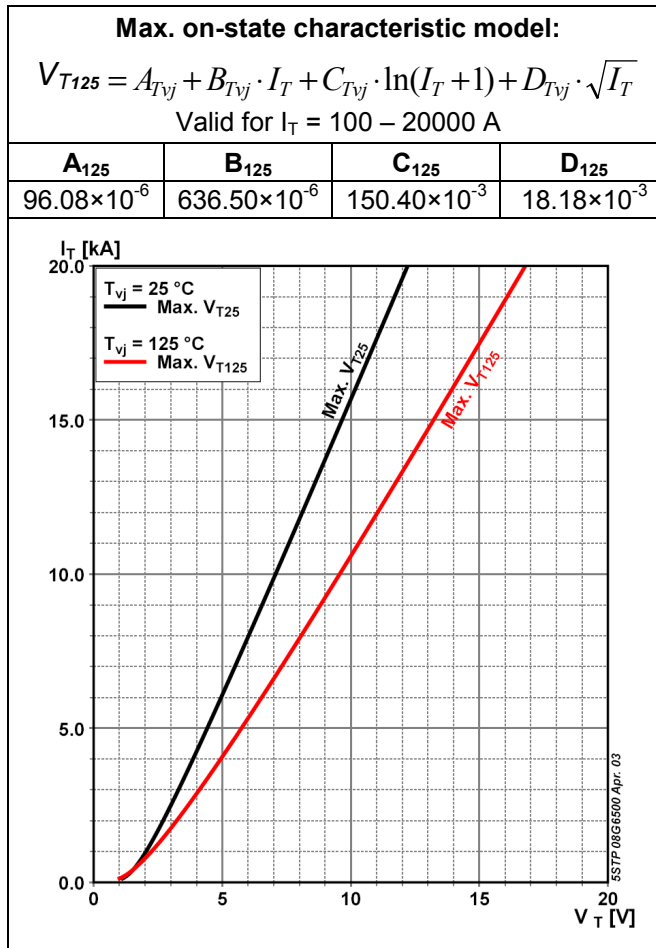


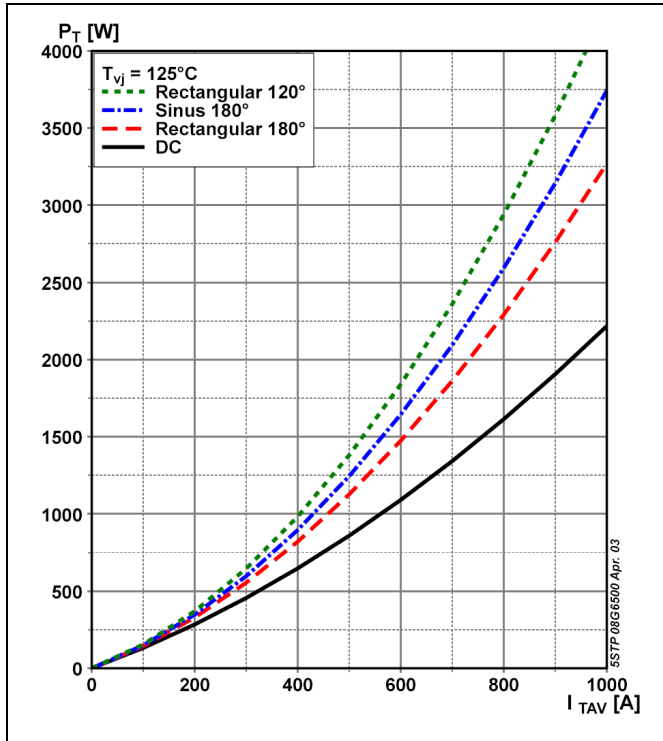
Fig. 1 Transient thermal impedance junction-to case.



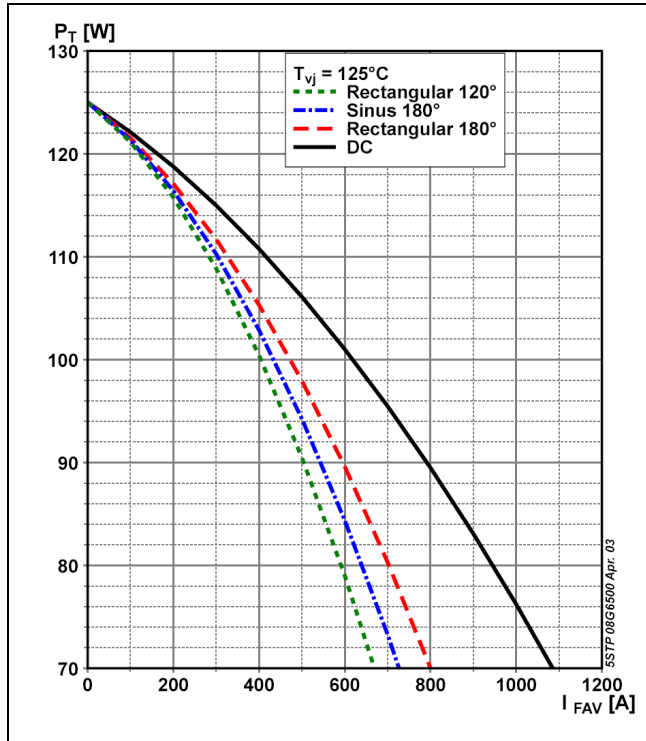
**Fig. 2** Max. on-state voltage characteristics



**Fig. 3** Max. 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.

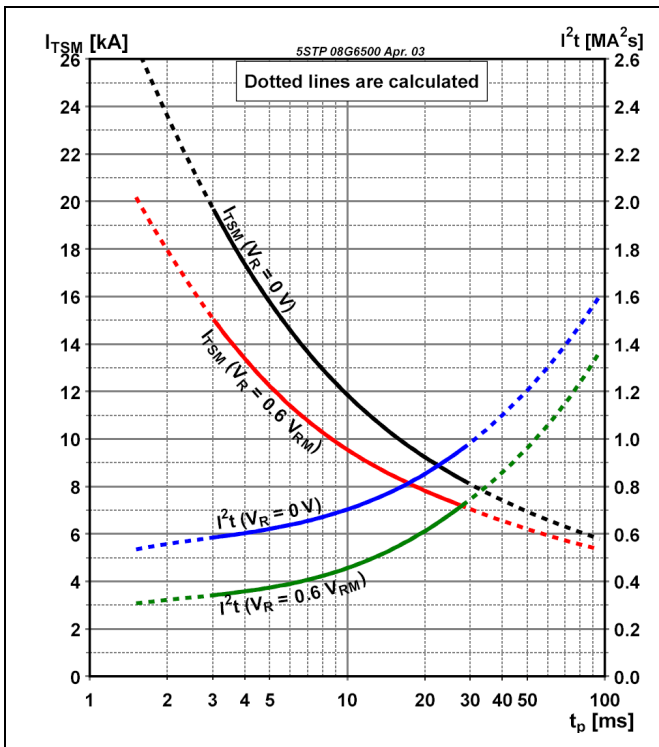


Fig. 6 Surge on-state current vs. pulse length. Half-sine wave.

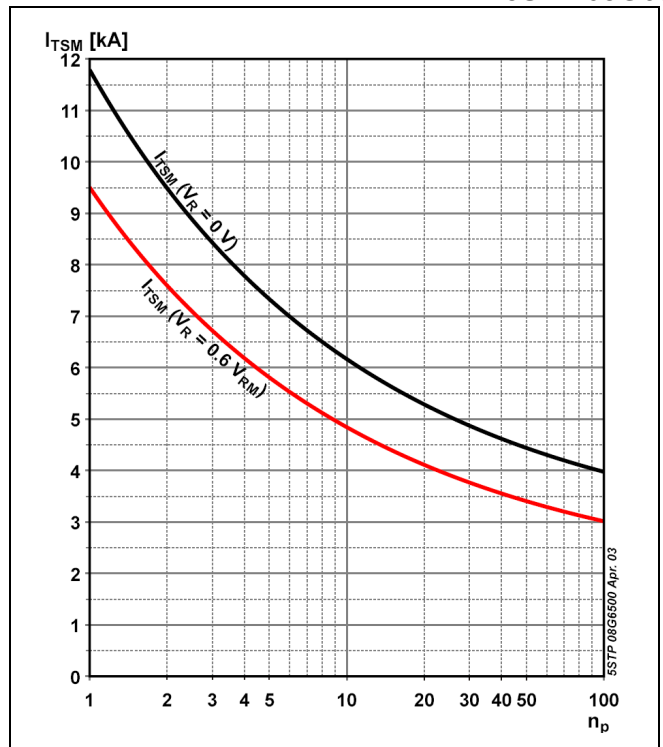


Fig. 7 Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.

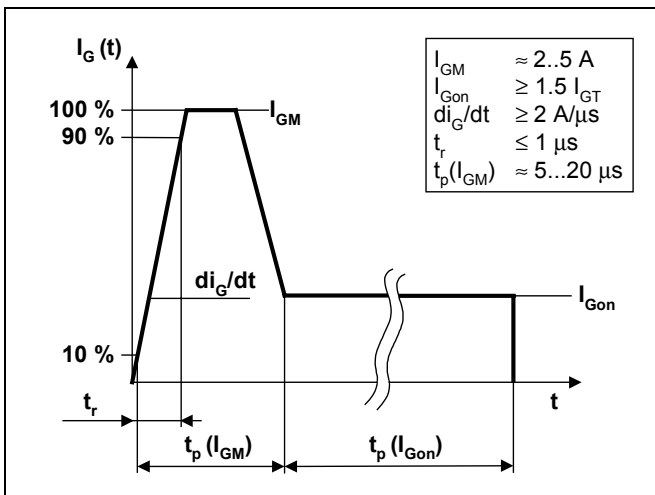


Fig. 8 Recommended gate current waveform.

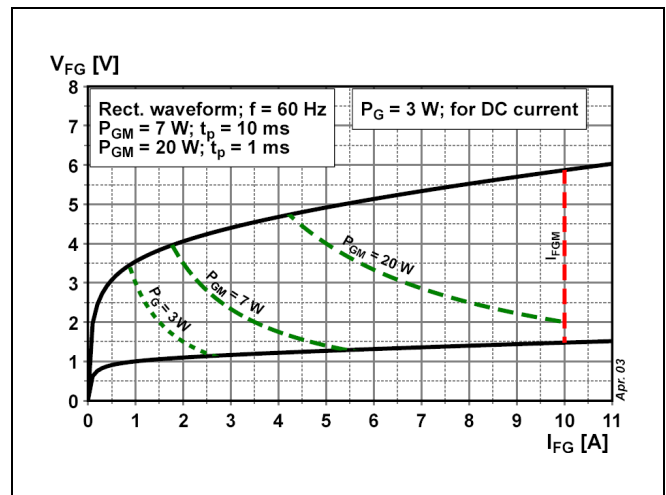


Fig. 9 Max. peak gate power loss.

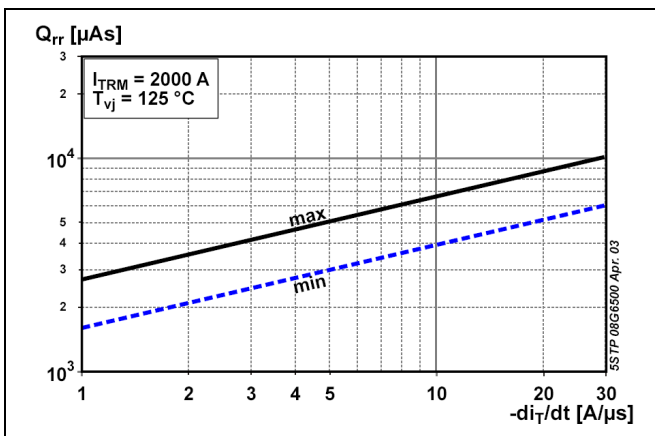


Fig. 10 Recovery charge vs. decay rate of on-state current.

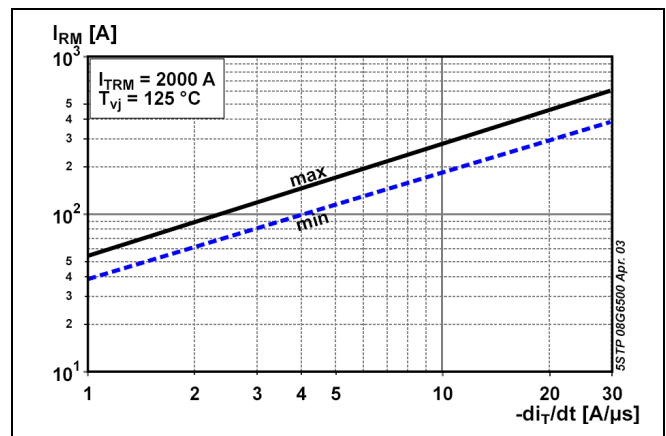


Fig. 11 Peak reverse recovery current vs. decay rate of on-state current.

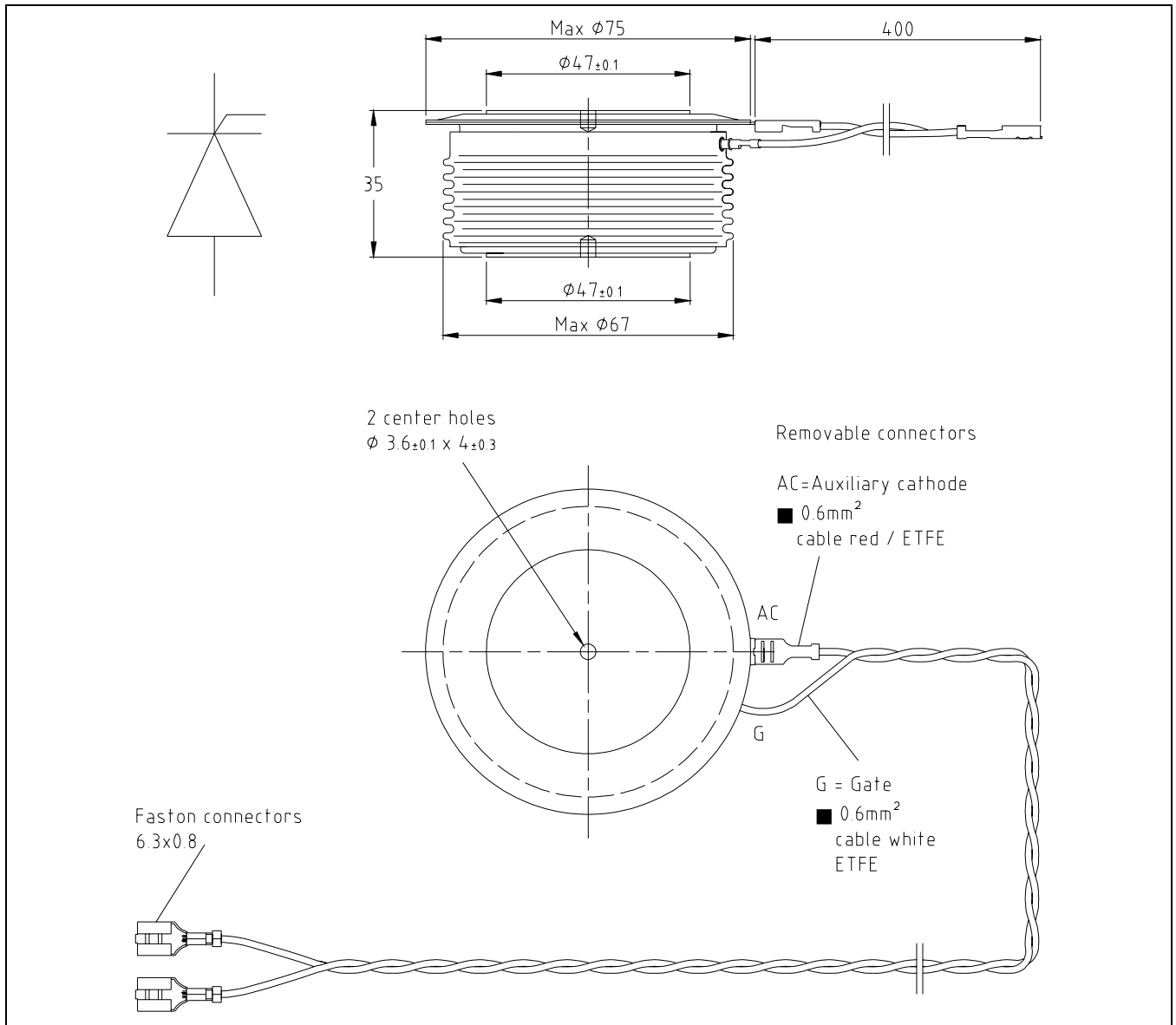


Fig. 12 Device Outline Drawing.

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