

$V_{DRM}$	= 1800	V
$I_{T(AV)M}$	= 6100	A
$I_{T(RMS)}$	= 9600	A
$I_{TSM}$	= $94 \times 10^3$	A
$V_{(T0)}$	= 0.9	V
$r_T$	= 0.05	m $\Omega$

# Phase Control Thyristor

## 5STP 50Q1800

Doc. No. 5SYA1070-01 Okt. 03

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

**Authorized Distributor:**  
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### Blocking

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

Symbol	Conditions	5STP 50Q1800	--	--
$V_{DRM}, V_{RRM}$	$f = 50 \text{ Hz}, t_p = 10 \text{ ms}$	1800 V	--	--
$V_{RSM}$	$t_p = 5 \text{ ms}, \text{ single pulse}$	2000 V	--	--
$dV/dt_{crit}$	Exp. to $0.67 \times V_{DRM}, T_{vj} = 125^\circ\text{C}$	1000 V/ $\mu\text{s}$		

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Forward leakage current	$I_{DRM}$	$V_{DRM}, T_{vj} = 125^\circ\text{C}$			300	mA
Reverse leakage current	$I_{RRM}$	$V_{RRM}, T_{vj} = 125^\circ\text{C}$			300	mA

### Mechanical data

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

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

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Weight	m				2.1	kg
Housing thickness	H	$F_M = 90 \text{ kN}, T_a = 25^\circ\text{C}$	25.5		26.5	mm
Surface creepage distance	$D_S$		36			mm
Air strike distance	$D_a$		15			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, $T_c = 70^\circ\text{C}$			6100	A
RMS on-state current	$I_{T(RMS)}$				9600	A
Peak non-repetitive surge current	$I_{TSM}$	$t_p = 10\text{ ms}$ , $T_{vj} = 125^\circ\text{C}$ , $V_D = V_R = 0\text{ V}$			$94 \times 10^3$	A
Limiting load integral	$I^2t$				$41.28 \times 10^6$	$\text{A}^2\text{s}$
Peak non-repetitive surge current	$I_{TSM}$	$t_p = 8.3\text{ ms}$ , $T_{vj} = 125^\circ\text{C}$ , $V_D = V_R = 0\text{ V}$			$100 \times 10^3$	A
Limiting load integral	$I^2t$				$43.37 \times 10^6$	$\text{A}^2\text{s}$

### Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	$V_T$	$I_T = 3000\text{ A}$ , $T_{vj} = 125^\circ\text{C}$			1.04	V
Threshold voltage	$V_{(T0)}$	$I_T = 4000\text{ A} - 18000\text{ A}$ , $T_{vj} = 125^\circ\text{C}$			0.9	V
Slope resistance	$r_T$				0.05	$\text{m}\Omega$
Holding current	$I_H$	$T_{vj} = 25^\circ\text{C}$			100	mA
		$T_{vj} = 125^\circ\text{C}$			75	mA
Latching current	$I_L$	$T_{vj} = 25^\circ\text{C}$			500	mA
		$T_{vj} = 125^\circ\text{C}$			350	mA

## Switching

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

Parameter	Symbol	Conditions	min	typ	max	Unit
Critical rate of rise of on-state current	$di/dt_{crit}$	$T_{vj} = 125^\circ\text{C}$ , $I_{TRM} = 3000\text{ A}$ , Cont. $f = 50\text{ Hz}$			250	$\text{A}/\mu\text{s}$
		$V_D \leq 0.67 V_{DRM}$ , $I_{FG} = 2\text{ A}$ , $t_r = 0.5\ \mu\text{s}$ Cont. $f = 1\text{ Hz}$			1000	$\text{A}/\mu\text{s}$
Circuit-commutated turn-off time	$t_q$	$T_{vj} = 125^\circ\text{C}$ , $I_{TRM} = 3000\text{ A}$ , $V_R = 200\text{ V}$ , $di_T/dt = -20\text{ A}/\mu\text{s}$ , $V_D \leq 0.67 \cdot V_{DRM}$ , $dv_D/dt = 20\text{ V}/\mu\text{s}$	500			$\mu\text{s}$

### Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Recovery charge	$Q_{rr}$	$T_{vj} = 125^\circ\text{C}$ , $I_{TRM} = 2000\text{ A}$ , $V_R = 200\text{ V}$ , $di_T/dt = -1.5\text{ A}/\mu\text{s}$			3000	$\mu\text{As}$
Gate turn-on delay time	$t_{gd}$	$V_D = 0.4 \cdot V_{RM}$ , $I_{FG} = 2\text{ A}$ , $t_r = 0.5\ \mu\text{s}$ , $T_{vj} = 25^\circ\text{C}$			3	$\mu\text{s}$

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# 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>vj</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>vj</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			5	K/kW
	R <sub>th(j-c)A</sub>	Anode-side cooled			10	K/kW
	R <sub>th(j-c)C</sub>	Cathode-side cooled			10	K/kW
Thermal resistance case to heatsink	R <sub>th(c-h)</sub>	Double-side cooled			1	K/kW
	R <sub>th(c-h)</sub>	Single-side cooled			2	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)	3.359	0.936	0.481	0.224
τ <sub>i</sub> (s)	0.4069	0.0854	0.0118	0.0030

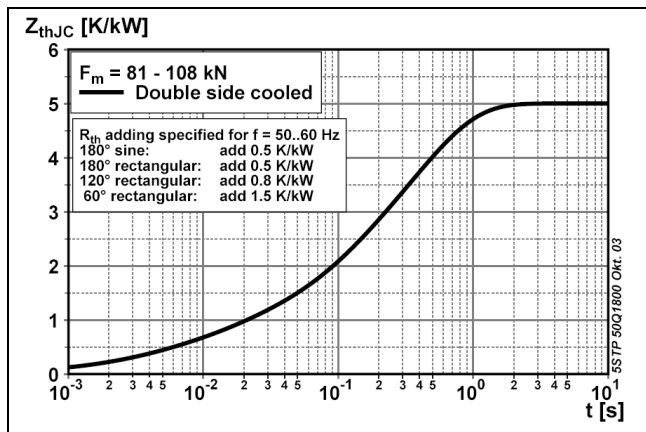
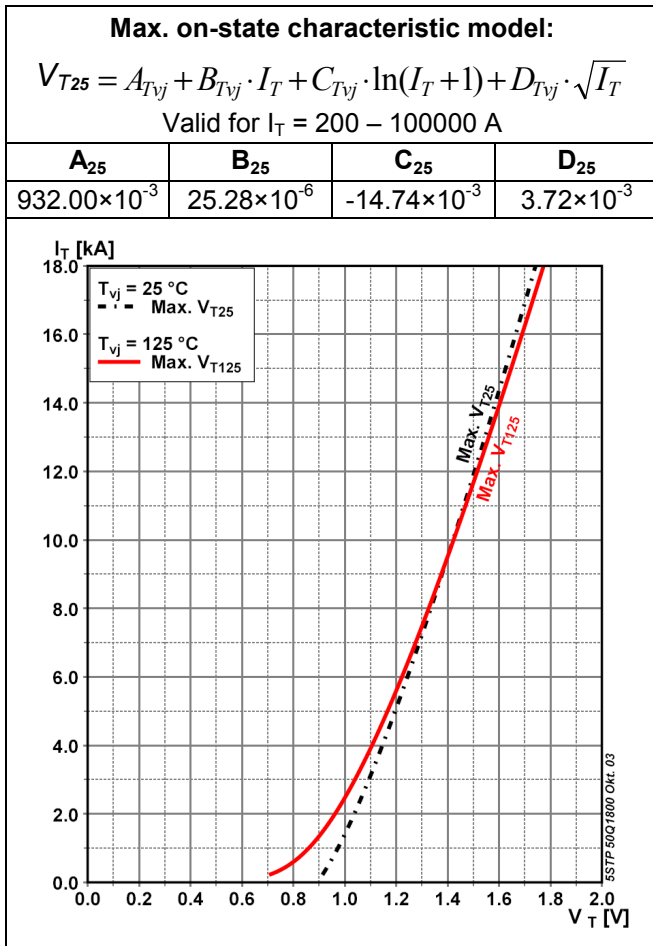
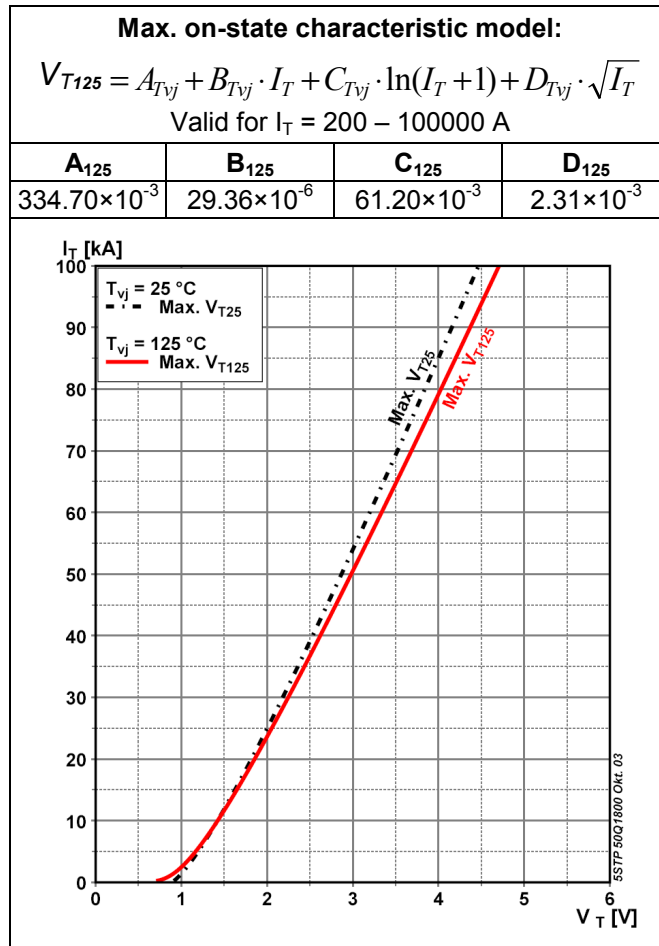


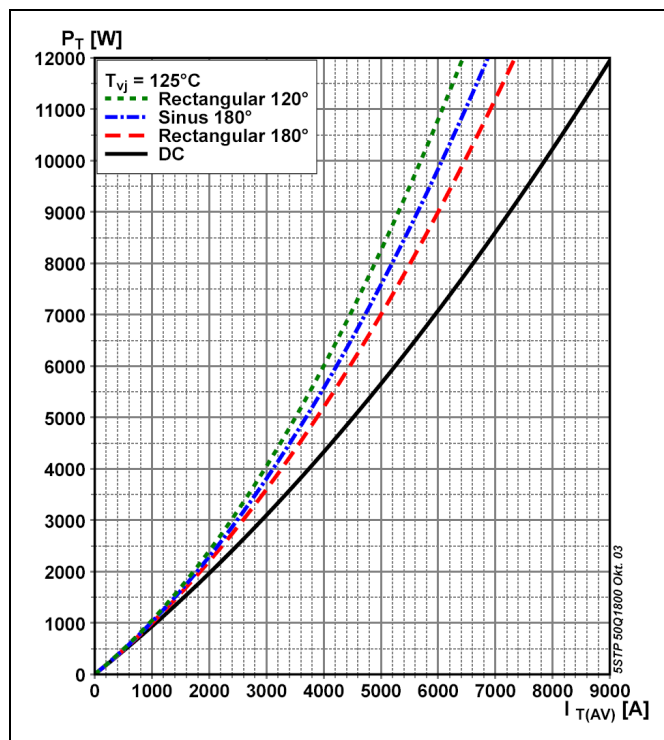
Fig. 1 Transient thermal impedance junction-to case.



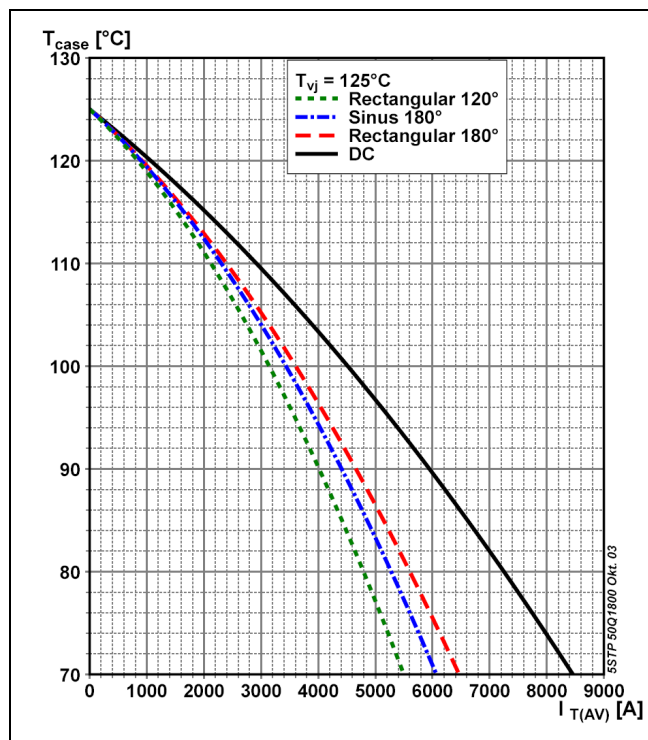
**Fig. 2** On-state characteristics.  
 $T_j = 125^\circ\text{C}$ , 10ms half sine



**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.

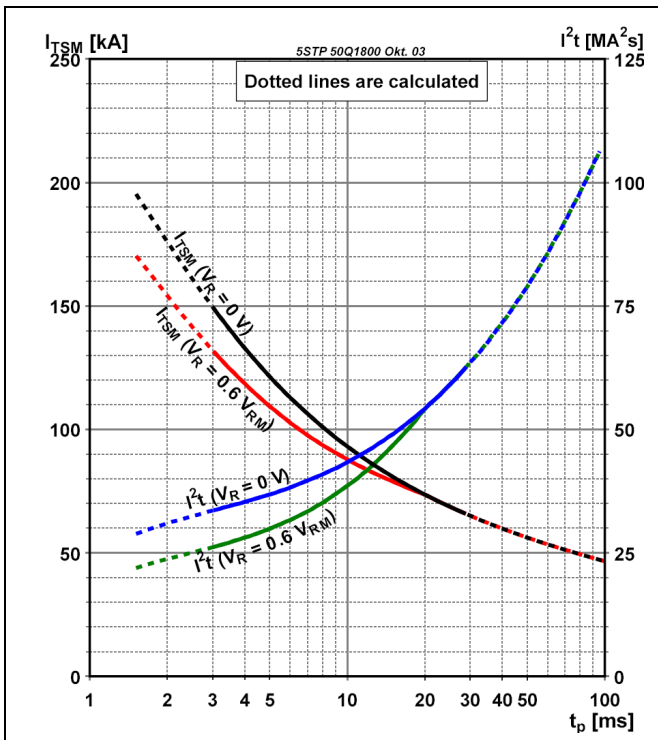


Fig. 6 Surge on-state current vs. pulse length. Half-sine wave.

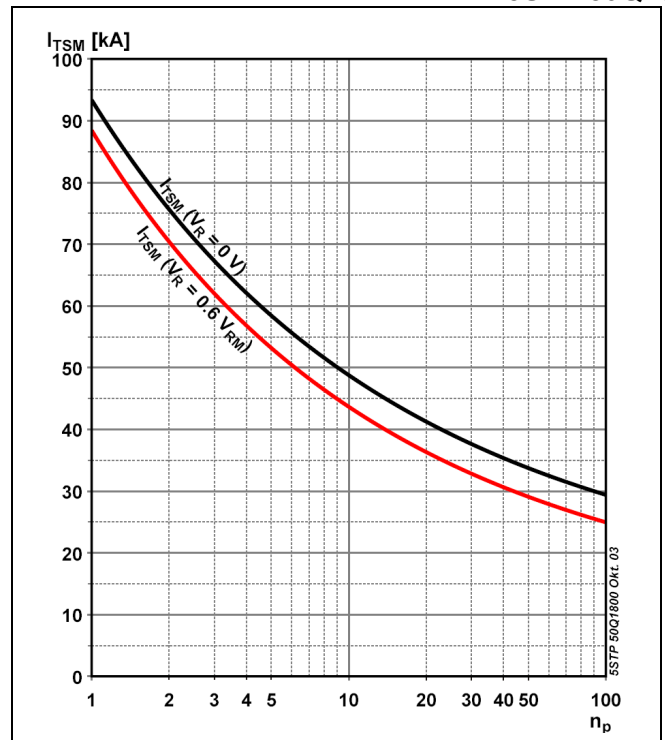


Fig. 7 Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.

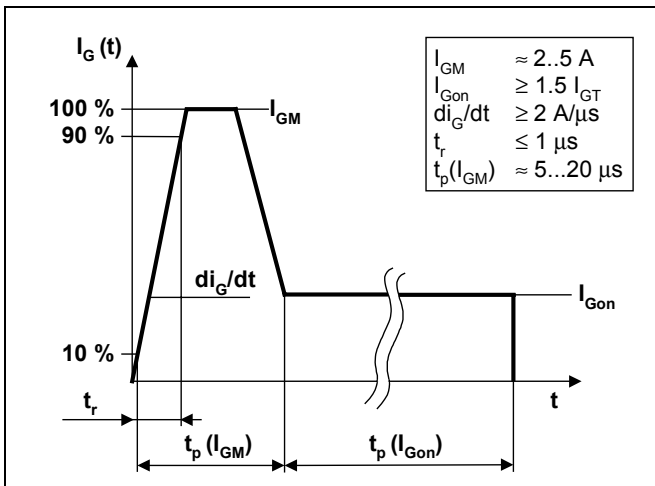


Fig. 8 Recommended gate current waveform.

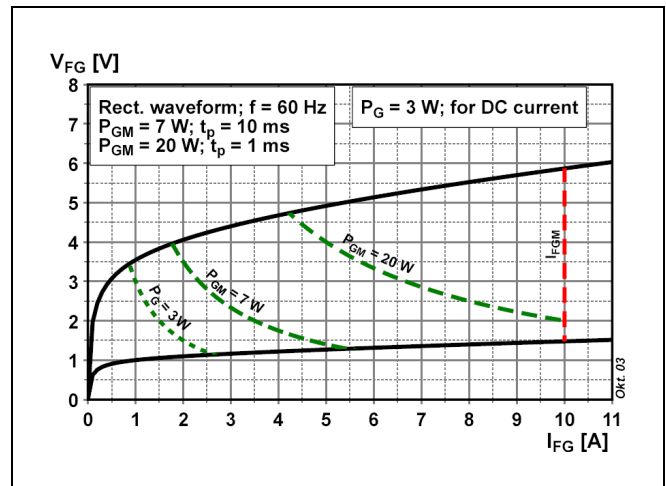


Fig. 9 Max. peak gate power loss.

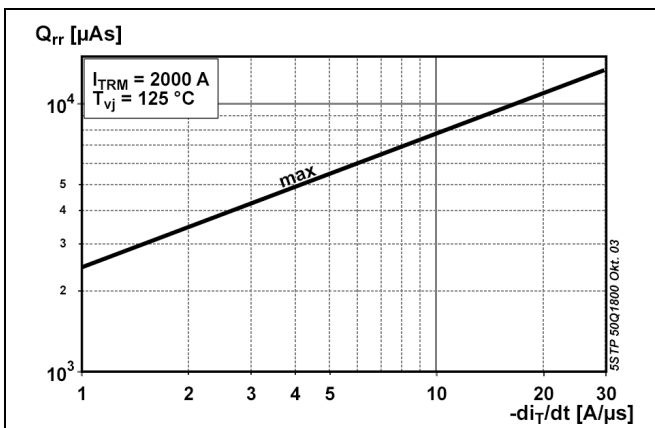


Fig. 10 Recovery charge vs. decay rate of on-state current.

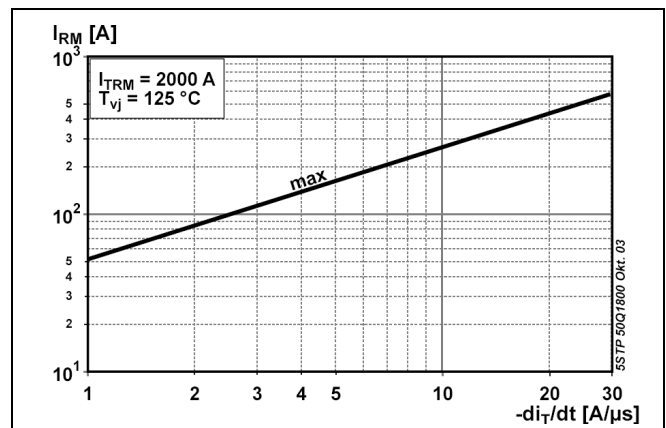


Fig. 11 Peak reverse recovery current vs. decay rate of on-state current.

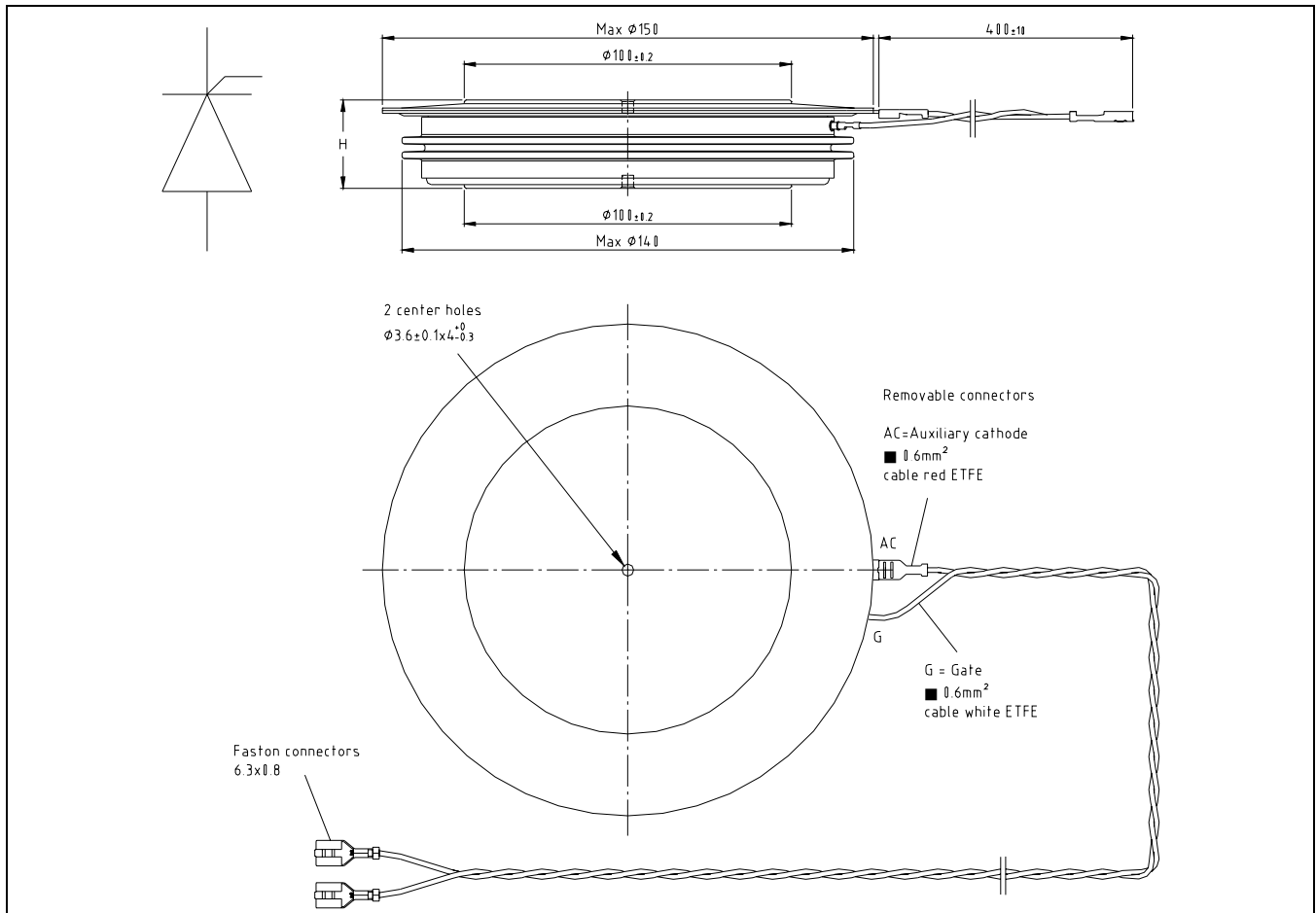


Fig. 12 Device Outline Drawing.

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