

$V_{DRM} = 5600$	V	<h1>Phase Control Thyristor</h1> <h2>5STP 12K6500</h2>
$V_{DSM} = 6500$	V	
$I_{T(AV)M} = 1370$	A	
$I_{T(RMS)} = 2160$	A	
$I_{TSM} = 21.9 \times 10^3$	A	
$V_{(T0)} = 1.18$	V	
$r_T = 0.632$	mW	

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- 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

Blocking

Maximum rated values ¹⁾

Symbol	Conditions	5STP 12K6500	5STP 12K6200	5STP 12K5800
V_{DSM}, V_{RSM}	$f = 5 \text{ Hz}, t_p = 10 \text{ ms}$	6500 V	6200 V	5800 V
V_{DRM}, V_{RRM}	$f = 50 \text{ Hz}, t_p = 10 \text{ ms}$	5600 V	5300 V	4900 V
dV/dt_{crit}	Exp. to 3750 V, $T_{vj} = 125^\circ\text{C}$	2000 V/ μs		

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Forward leakage current	I_{DSM}	$V_{DSM}, T_{vj} = 125^\circ\text{C}$			600	mA
Reverse leakage current	I_{RSM}	$V_{RSM}, T_{vj} = 125^\circ\text{C}$			600	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 ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	F_M		45	50	60	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				1.15	kg
Housing thickness	H	$F_M = 50 \text{ kN}, T_a = 25^\circ\text{C}$				mm
Surface creepage distance	D_s		45			mm
Air strike distance	D_a		24			mm

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

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On-state
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Maximum rated values

Parameter	Symbol	Conditions	min	typ	max	Unit
Average on-state current	$I_{T(AV)M}$	Half sine wave, $T_c = 70^\circ\text{C}$			1370	A
RMS on-state current	$I_{T(RMS)}$				2160	A
Peak non-repetitive surge current	I_{TSM}	$t_p = 10\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, $V_D = V_R = 0\text{ V}$			21.9×10^3	A
Limiting load integral	I^2t				2.4×10^6	A^2s
Peak non-repetitive surge current	I_{TSM}	$t_p = 8.3\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, $V_D = V_R = 0\text{ V}$			23.35×10^3	A
Limiting load integral	I^2t				2.26×10^6	A^2s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_T	$I_T = 1500\text{ A}$, $T_{vj} = 125^\circ\text{C}$			2.12	V
Threshold voltage	$V_{(T0)}$	$I_T = 800\text{ A} - 2000\text{ A}$, $T_{vj} = 125^\circ\text{C}$			1.18	V
Slope resistance	r_T				0.632	$\text{m}\Omega$
Holding current	I_H	$T_{vj} = 25^\circ\text{C}$			125	mA
		$T_{vj} = 125^\circ\text{C}$			75	mA
Latching current	I_L	$T_{vj} = 25^\circ\text{C}$			600	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}	$T_{vj} = 125^\circ\text{C}$, $I_{TRM} = 1300\text{ A}$, Cont. $f = 50\text{ Hz}$			250	$\text{A}/\mu\text{s}$
Critical rate of rise of on-state current	di/dt_{crit}	$V_D \leq 3750\text{ V}$, $I_{FG} = 2\text{ A}$, $t_r = 0.5\ \mu\text{s}$ Cont. $f = 1\text{ Hz}$			1000	$\text{A}/\mu\text{s}$
Circuit-commutated turn-off time	t_q	$T_{vj} = 125^\circ\text{C}$, $I_{TRM} = 800\text{ A}$, $V_R = 200\text{ V}$, $di_T/dt = -1\ \text{A}/\mu\text{s}$, $V_D \leq 0.67 \cdot V_{DRM}$, $dV_D/dt = 20\text{V}/\mu\text{s}$	800			μs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Recovery charge	Q_{rr}	$T_{vj} = 125^\circ\text{C}$, $I_{TRM} = 2000\text{ A}$, $V_R = 200\text{ V}$, $di_T/dt = -1\ \text{A}/\mu\text{s}$	1600		2600	μAs
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	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. 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 F _m = 45...60 kN			11	K/kW
	R _{th(j-c)A}	Anode-side cooled F _m = 45...60 kN			22	K/kW
	R _{th(j-c)C}	Cathode-side cooled F _m = 45...60 kN			22	K/kW
Thermal resistance case to heatsink	R _{th(c-h)}	Double-side cooled F _m = 45...60 kN			2	K/kW
	R _{th(c-h)}	Single-side cooled F _m = 45...60 kN			4	K/kW

Analytical function for transient thermal impedance:

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

i	1	2	3	4
R _{thi} (K/kW)	7.347	2.414	0.797	0.447
τ _i (s)	0.9879	0.0995	0.0157	0.0040

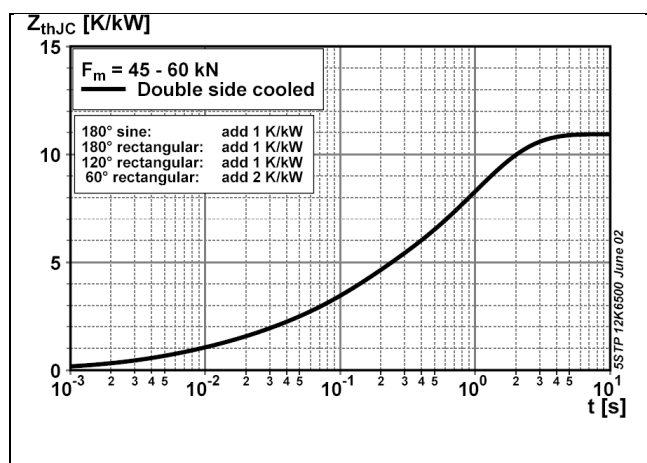


Fig. 1 Transient thermal impedance junction-to case.

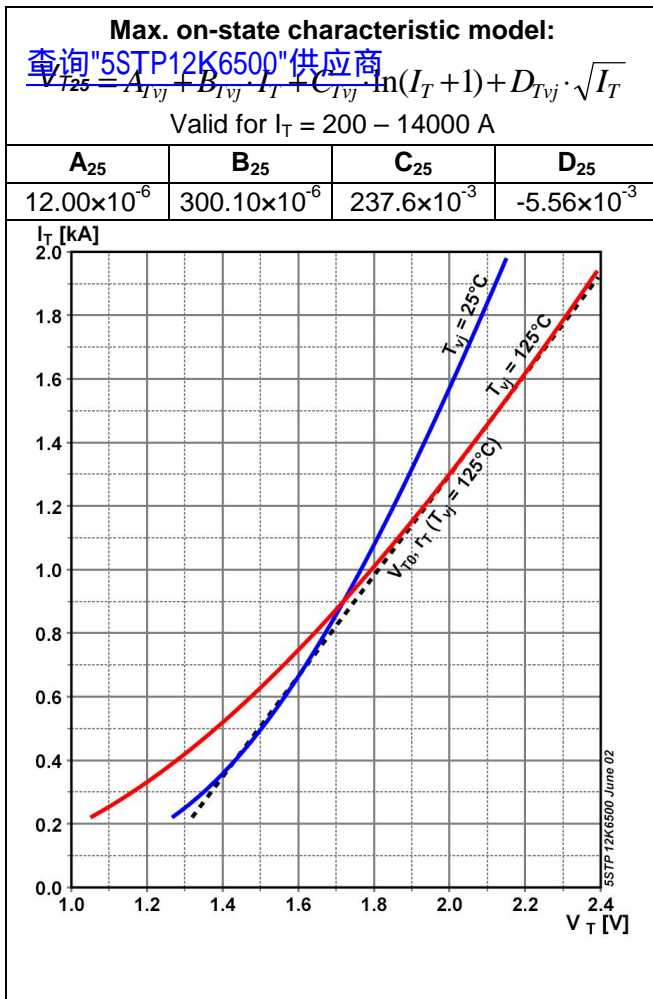


Fig. 2 Max. on-state voltage characteristics

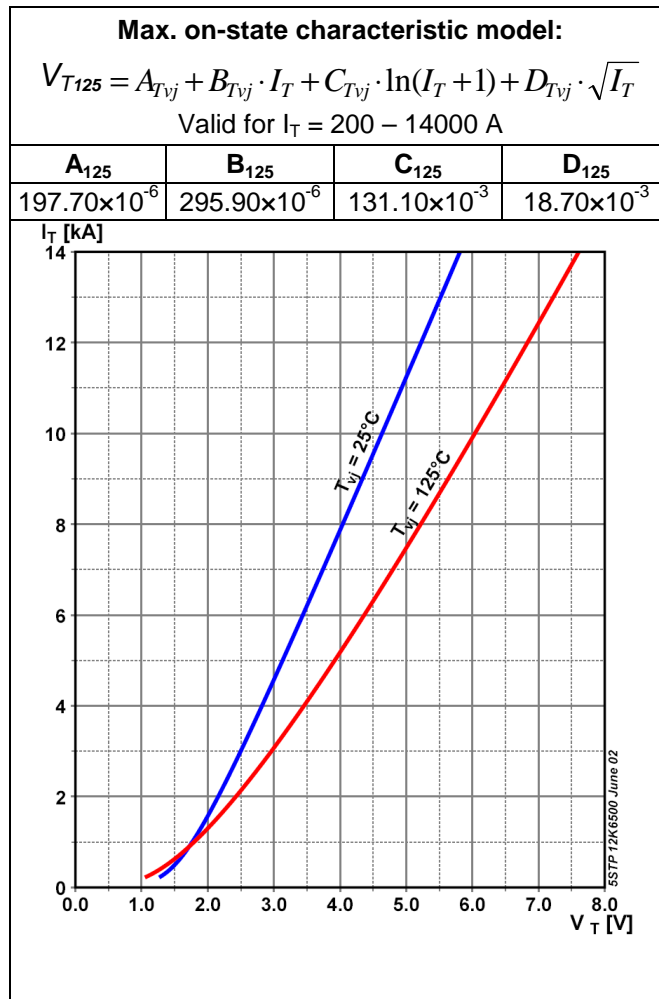


Fig. 3 Max. on-state voltage characteristics

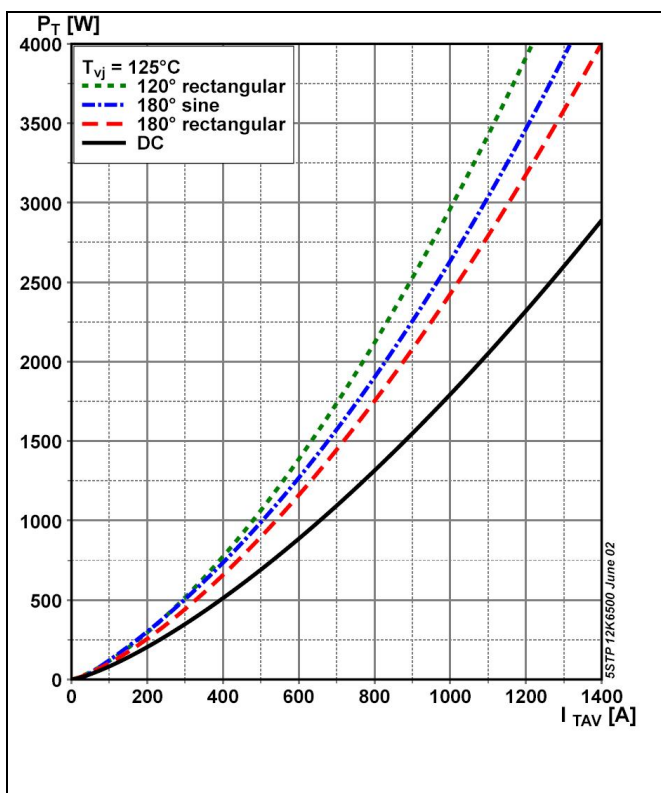


Fig. 4 On-state power dissipation vs. mean on-state current. Turn-on losses excluded.

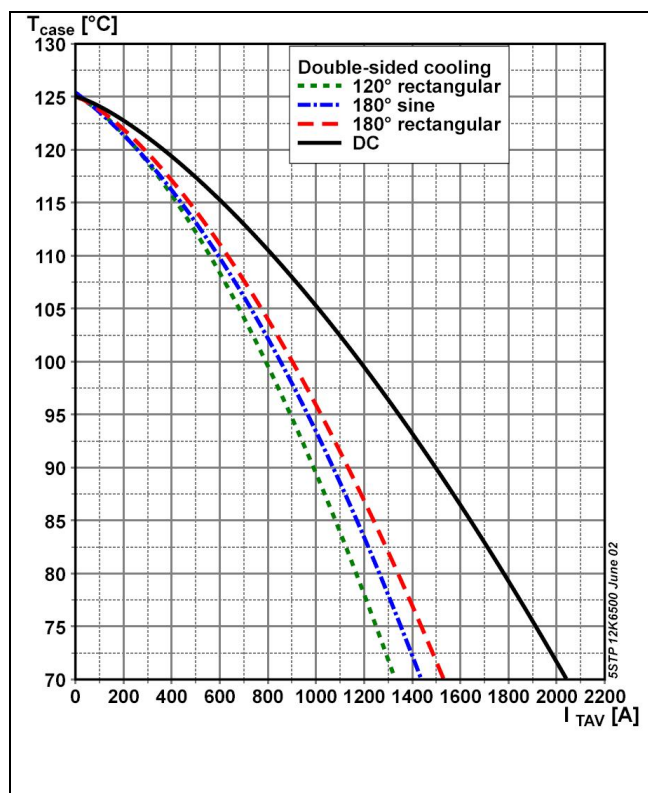


Fig. 5 Max. permissible case temperature vs. mean on-state current.

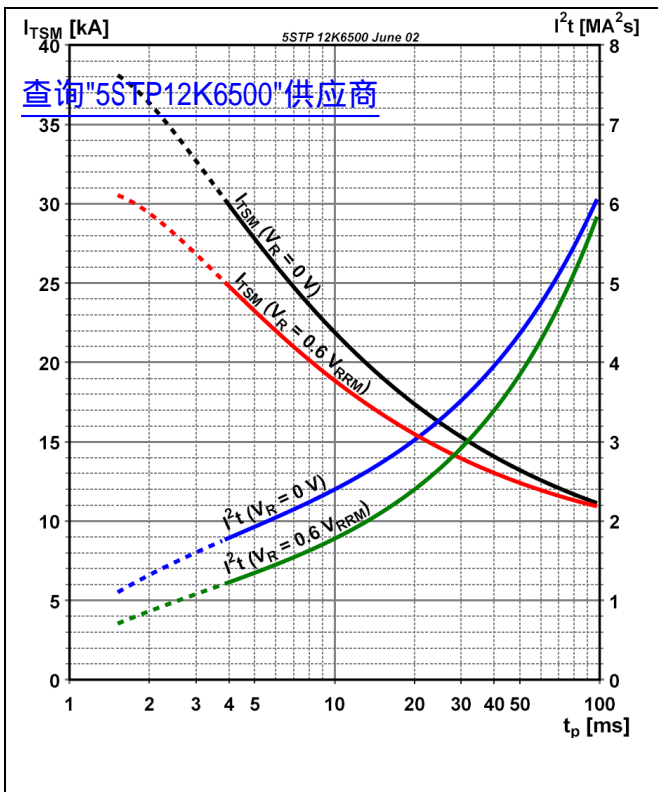


Fig. 6 Surge on-state current vs. pulse length. Half-sine wave.

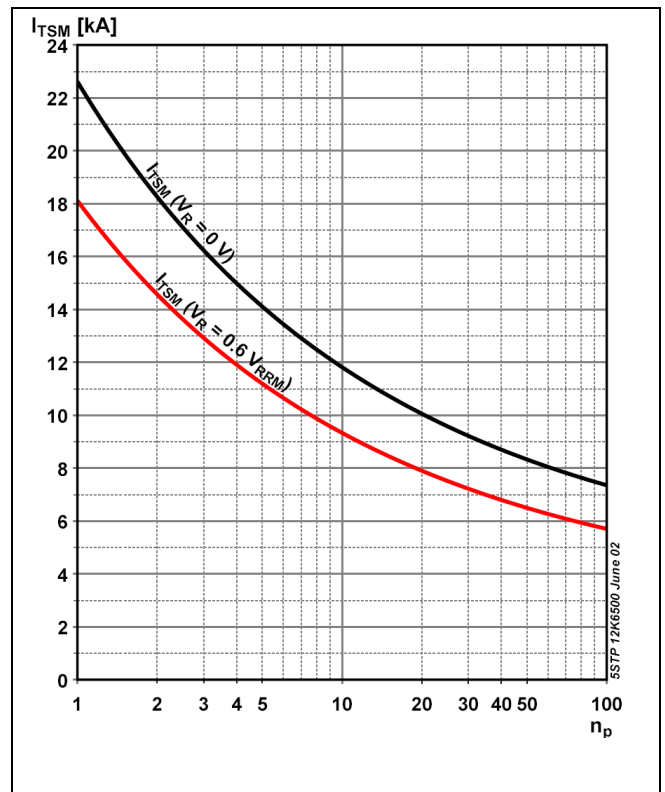


Fig. 7 Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.

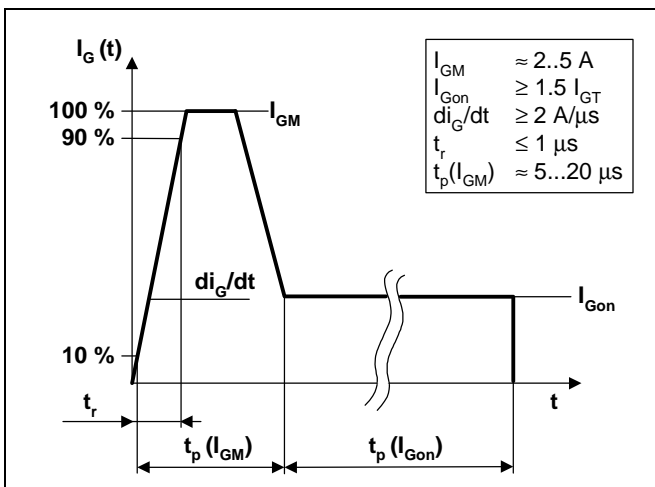


Fig. 8 Recommended gate current waveform.

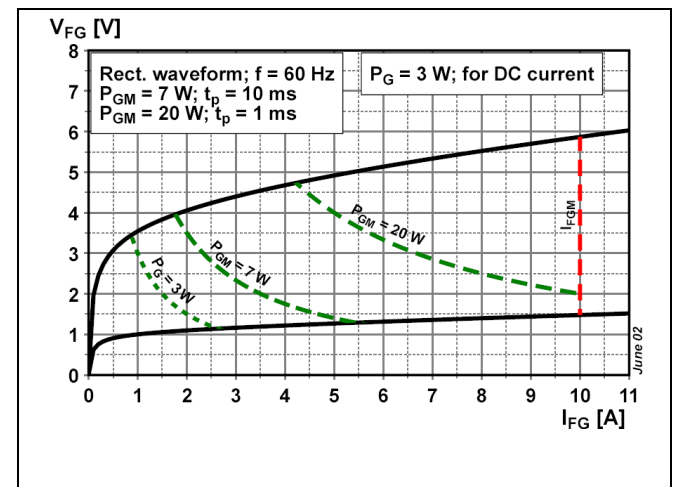


Fig. 9 Max. peak gate power loss.

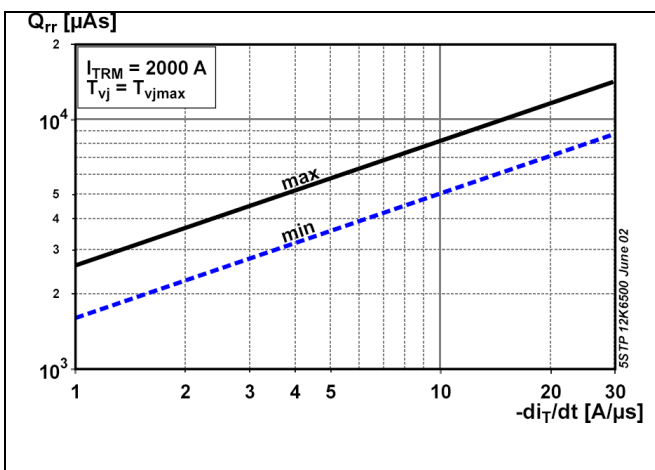


Fig. 10 Recovery charge vs. decay rate of on-state current.

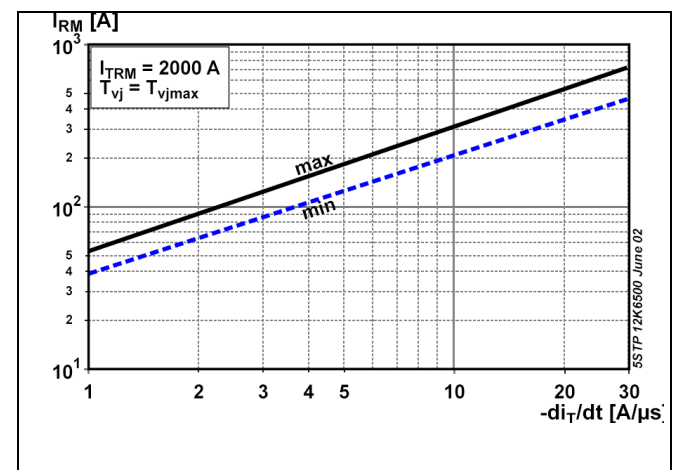


Fig. 11 Peak reverse recovery current vs. decay rate of on-state current.

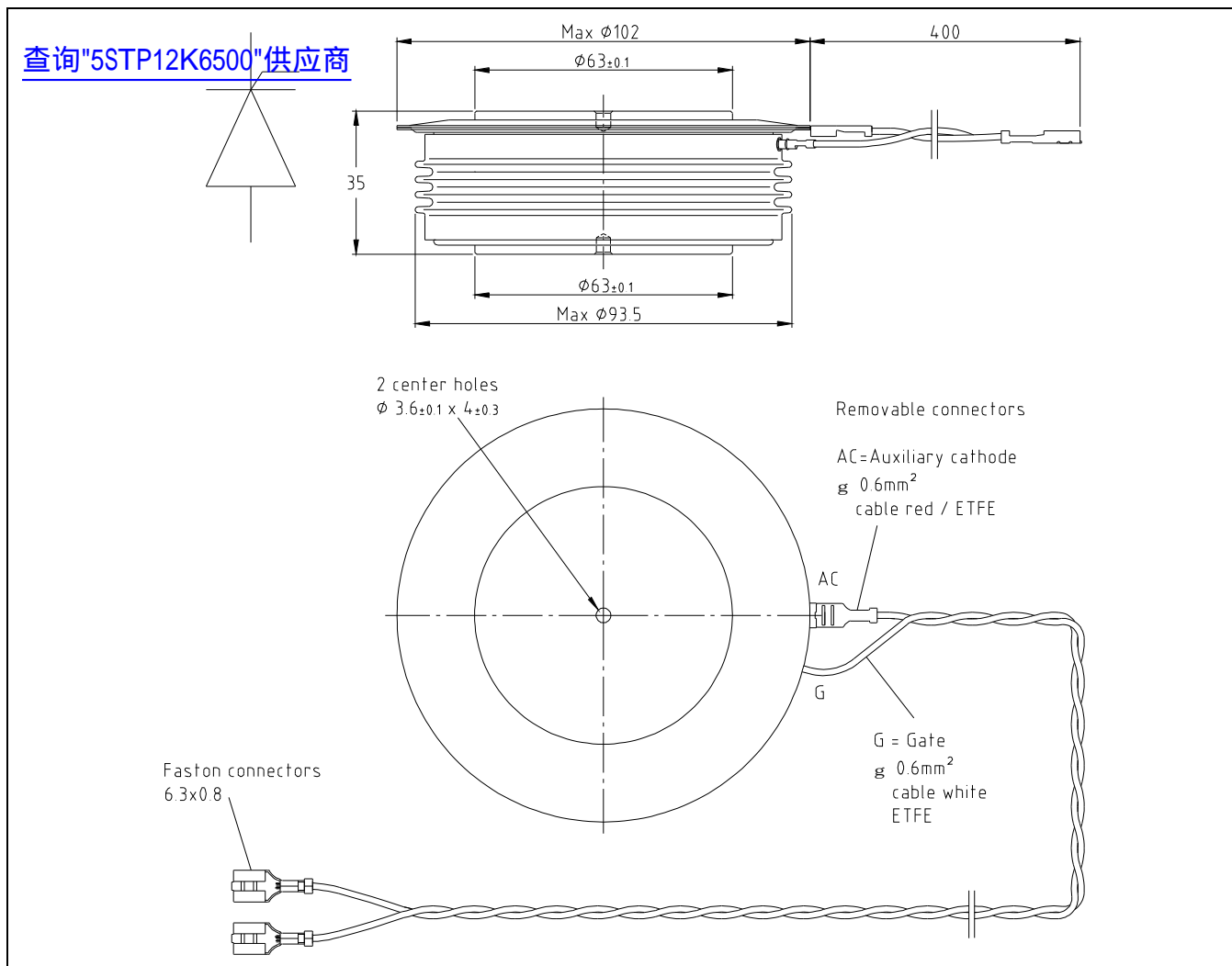


Fig. 12 Device Outline Drawing.

Related application notes:

Doc. Nr	Titel
5SYA2020	Design of RC-Snubber for Phase Control Applications
5SYA2034	Gate-drive Recommendations for PCT's
5SYA 2036	Recommendations regarding mechanical clamping of Press Pack High Power Semiconductors

Please refer to <http://www.abb.com/semiconductors> for actual versions.

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