V_{SM}	=	5200 V
$I_{T(AV)M}$	=	1980 A
$I_{T(RMS)}$	=	3100 A
I_{TSM}	=	42×10 A
V_{T0}	=	1.06 V
r_T	=	0.219 mΩ

Bi-Directional Control Thyristor

5STB 25U5200

Preliminary

Doc. No. 5SYA1038-02 Jul. 03

- **Two thyristors integrated into one wafer**
- **Patented free-floating silicon technology**
- **Designed for energy and industrial applications**
- **Optimum power handling capability**
- **Interdigitated amplifying gate.**

The electrical and thermal data are valid for one thyristor half of the device.

Blocking

Maximum rated values [1)]

Symbol	Conditions	5STB 25U5200	5STB 25U5000	5STB 25U4600
V_{SM}	f = 5 Hz, t_p = 10 ms	5200 V	5000 V	4600 V
V_{RM}	f = 50 Hz, t_p = 10 ms	4400 V	4200 V	4000 V
dV/dt_{crit}	Exp. to 0.67 x V_{RM}, T_{vj} = 110°C	2000 V/µs		

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. leakage current	I_{RM}	V_{RM}, T_{vj} = 110°C			400	mA

V_{RM} is equal to the V_{SM} value up to T_j = 95 °C

Mechanical data

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	F_M		120	135	160	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				3.6	kg
Surface creepage distance	D_S		53			mm
Air strike distance	D_a		22			mm

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

On-state

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Average on-state current	$I_{T(AV)M}$	Half sine wave, T_c = 70°C			1980	A
RMS on-state current	$I_{T(RMS)}$				3100	A
Peak non-repetitive surge current	I_{TSM}	tp = 10 ms, T_{vj} = 110 °C, $V_D = V_R$ = 0 V			42.0×10^3	A
Limiting load integral	I^2t				8.82×10^6	A^2s
Peak non-repetitive surge current	I_{TSM}	tp = 8.3 ms, T_{vj} = 110 °C, $V_D = V_R$ = 0 V			45.0×10^3	A
Limiting load integral	I^2t				8.40×10^6	A^2s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_T	I_T = 3000 A, T_{vj} = 110 °C			1.7	V
Threshold voltage	V_{T0}	I_T = 1300 A - 4000 A, T_{vj}= 110 °C			1.06	V
Slope resistance	r_T				0.219	mΩ
Holding current	I_H	T_{vj} = 25 °C			125	mA
		T_{vj} = 110 °C			70	mA
Latching current	I_L	T_{vj} = 25 °C			900	mA
		T_{vj} = 110 °C			700	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} = 110 °C, I_{TRM} = 3000 A,	Cont. f = 50 Hz			250	A/µs
Critical rate of rise of on-state current	di/dt_{crit}	$V_D \le 0.67\ V_{RM}$, I_{FG} = A, t_r = 0.5 µs	Cont. f = 1Hz			1000	A/µs
Circuit commutated turn-off time	t_q	T_{vj} = 110°C, I_{TRM} = 2000 A, V_R = 200 V, di_T/dt = -1.5 A/µs, $V_D \le 0.67 \cdot V_{RM}$, dv_D/dt = 20V/µs,		800			µs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Recovery charge	Q_{rr}	T_{vj} = 110°C, I_{TRM} = 2000 A, V_R = 200 V, di_T/dt = -1.5 A/µs	3600		4600	µAs
Delay time	t_d	$V_D = 0.4 \cdot V_{RM}$, I_{FG} = 2 A, t_r = 0.5 µs			3	µs

Triggering

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Peak forward gate voltage	V_{FGM}				12	V
Max. rated peak forward gate current	I_{FGM}				10	A
Peak reverse gate voltage	V_{RGM}				10	V
Max. rated gate power loss	P_G	For DC gate current			3	W
Max. rated peak forward gate power	P_{GM}		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_{RM}, T_{vjmax} = 110 °C	0.3			V
Gate non-trigger current	I_{GD}	V_D = 0.4 x V_{RM}	10			mA

Thermal

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Operating junction temperature range	T_{vj}				110	°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			8.5	K/kW
	$R_{th(j-c)A}$	Anode-side cooled			17	K/kW
	$R_{th(j-c)C}$	Cathode-side cooled			17	K/kW
Thermal resistance case to heatsink	$R_{th(c-h)}$	Double-side cooled			1.6	K/kW
	$R_{th(c-h)}$	Single-side cooled			3.2	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_i(K/kW)	5.748	1.731	0.688	0.333
τ_i(s)	0.9531	0.1240	0.0144	0.0031

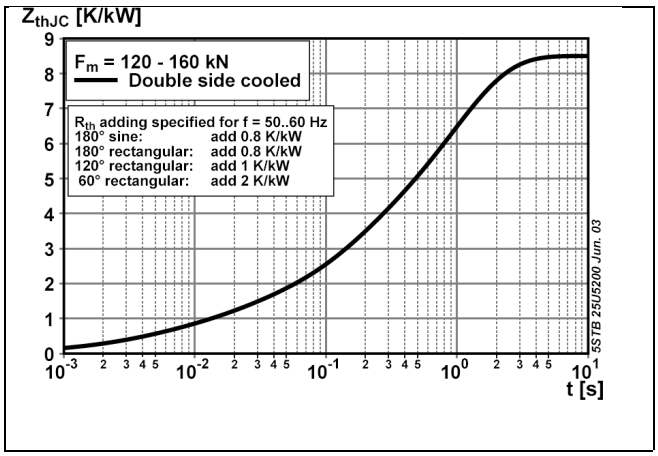

Fig. 1 Transient thermal impedance junction-to case.

Max. on-state characteristic model:

$$V_{T25} = A_{Tvj} + B_{Tvj} \cdot I_T + C_{Tvj} \cdot \ln(I_T + 1) + D_{Tvj} \cdot \sqrt{I_T}$$

Valid for I_T = 500 – 80000 A

A_{25}	B_{25}	C_{25}	D_{25}
200.70×10^{-6}	116.90×10^{-6}	176.4×10^{-3}	-2.52×10^{-3}

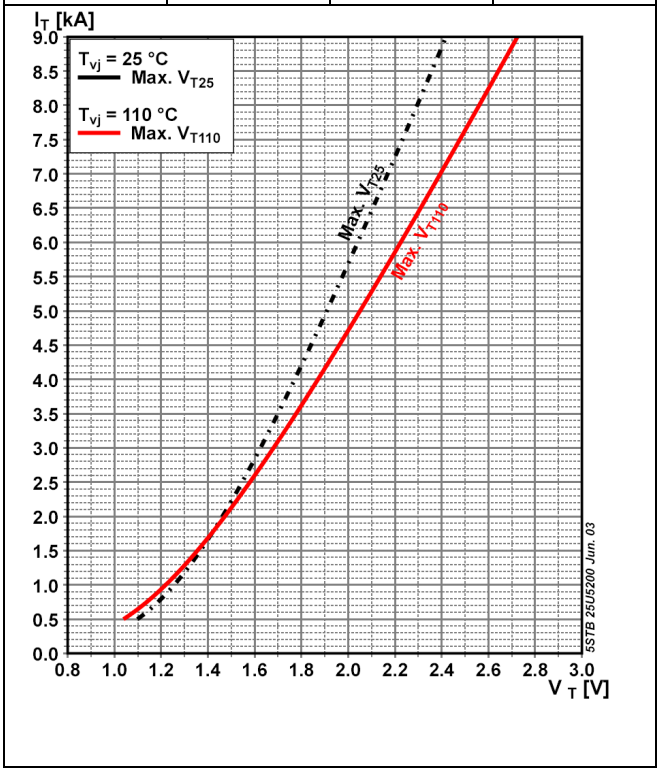

Fig. 2 Max. on-state voltage characteristics

Max. on-state characteristic model:

$$V_{T110} = A_{Tvj} + B_{Tvj} \cdot I_T + C_{Tvj} \cdot \ln(I_T + 1) + D_{Tvj} \cdot \sqrt{I_T}$$

Valid for I_T = 500 – 80000 A

A_{110}	B_{110}	C_{110}	D_{110}
157.10×10^{-6}	145.60×10^{-6}	155.60×10^{-3}	-27.48×10^{-6}

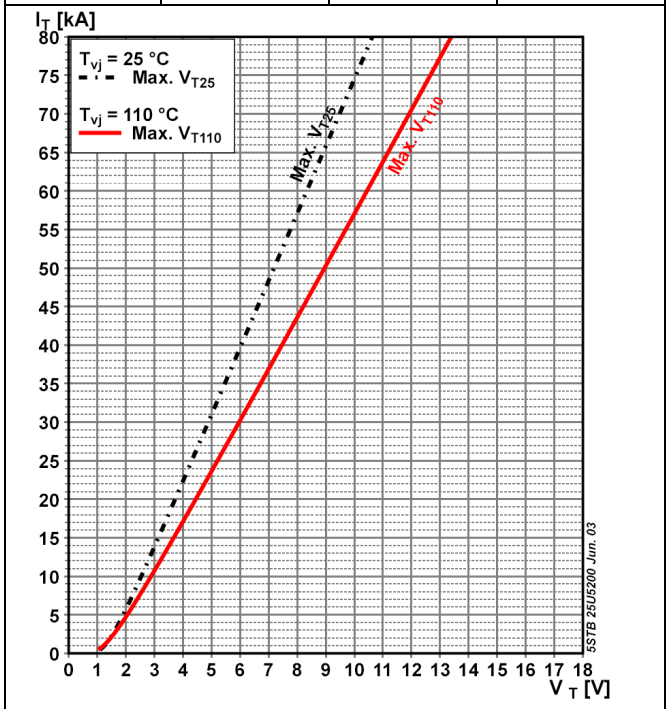

Fig. 3 Max. on-state voltage characteristics

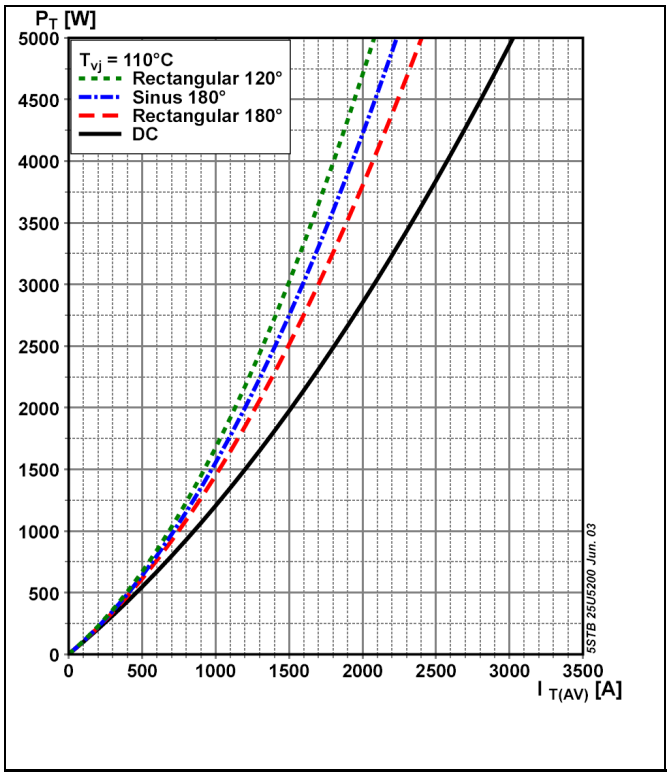

Fig. 4 On-state power dissipation vs. mean on-state current. Turn - on losses excluded.

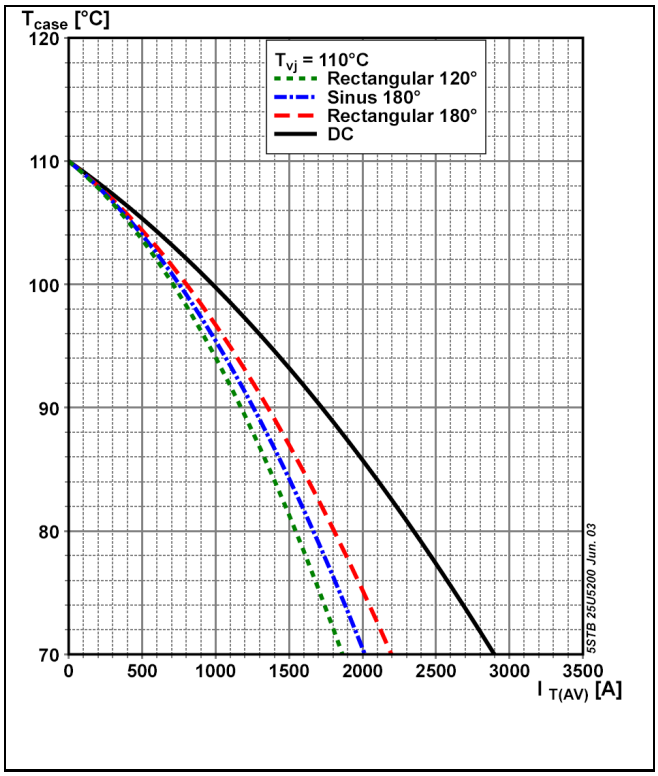

Fig. 5 Max. permissible case temperature vs. mean on-state current.

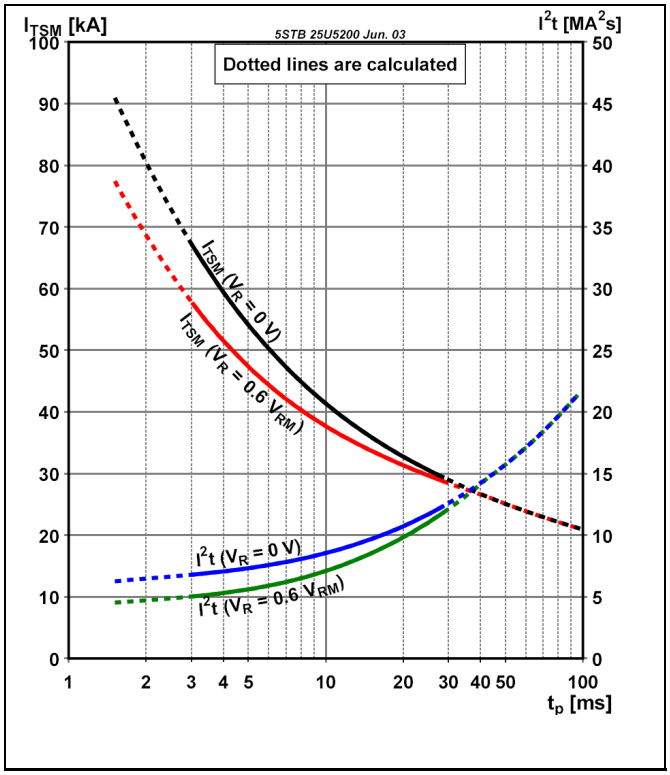

Fig. 6 Surge on-state current vs. pulse length. Half-sine wave.

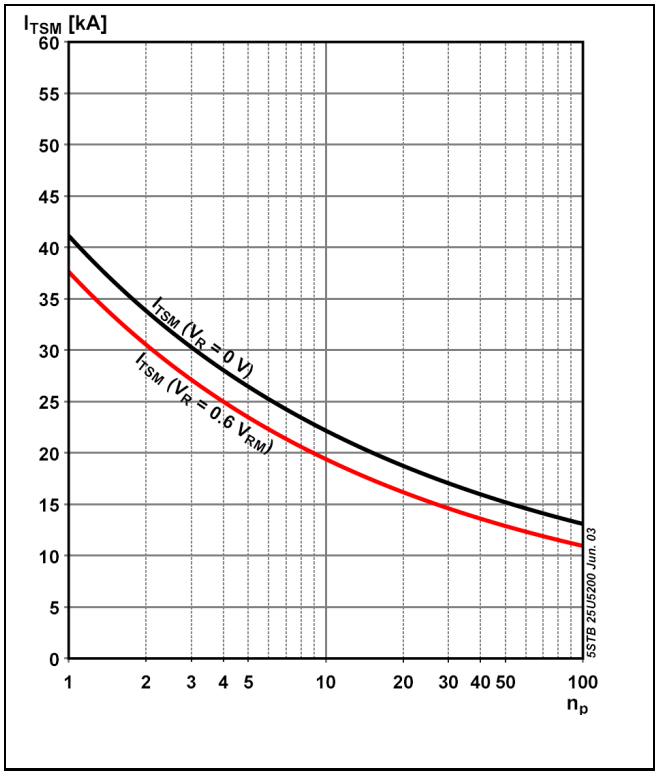

Fig. 7 Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.

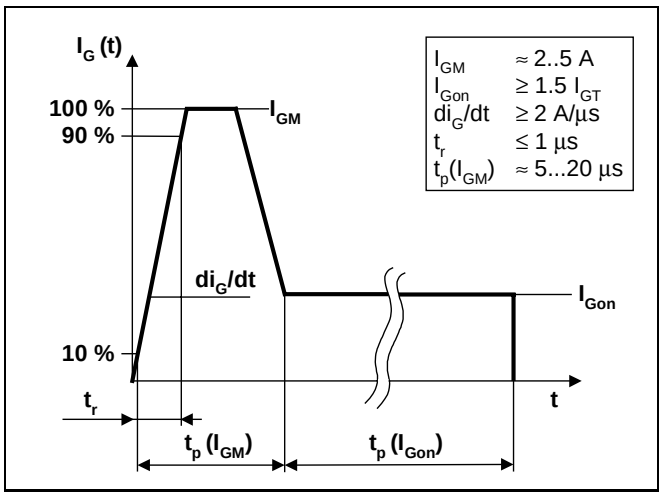

Fig. 8 Recommended gate current waveform.

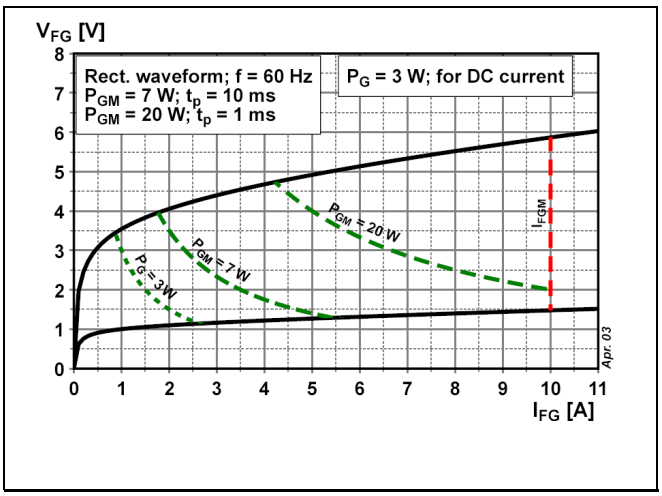

Fig. 9 Max. peak gate power loss.

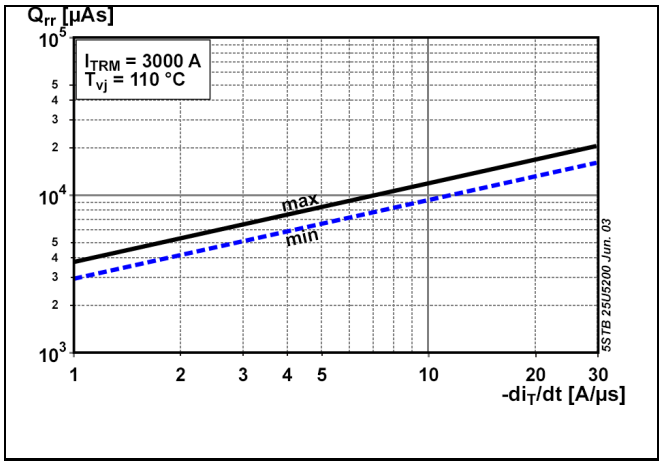

Fig. 10 Recovery charge vs. decay rate of on-state current.

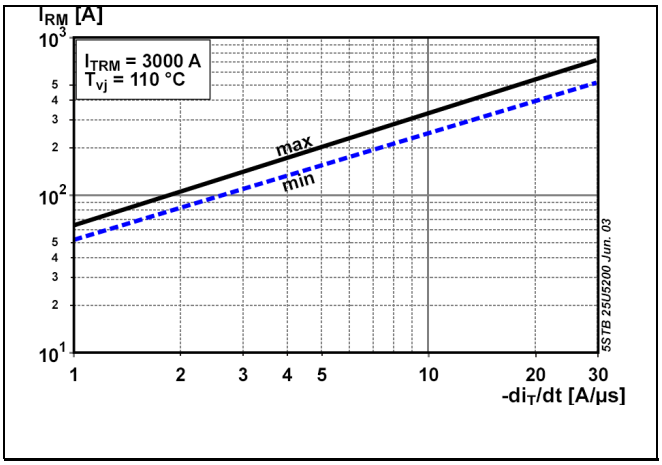

Fig. 11 Peak reverse recovery current vs. decay rate of on-state current.

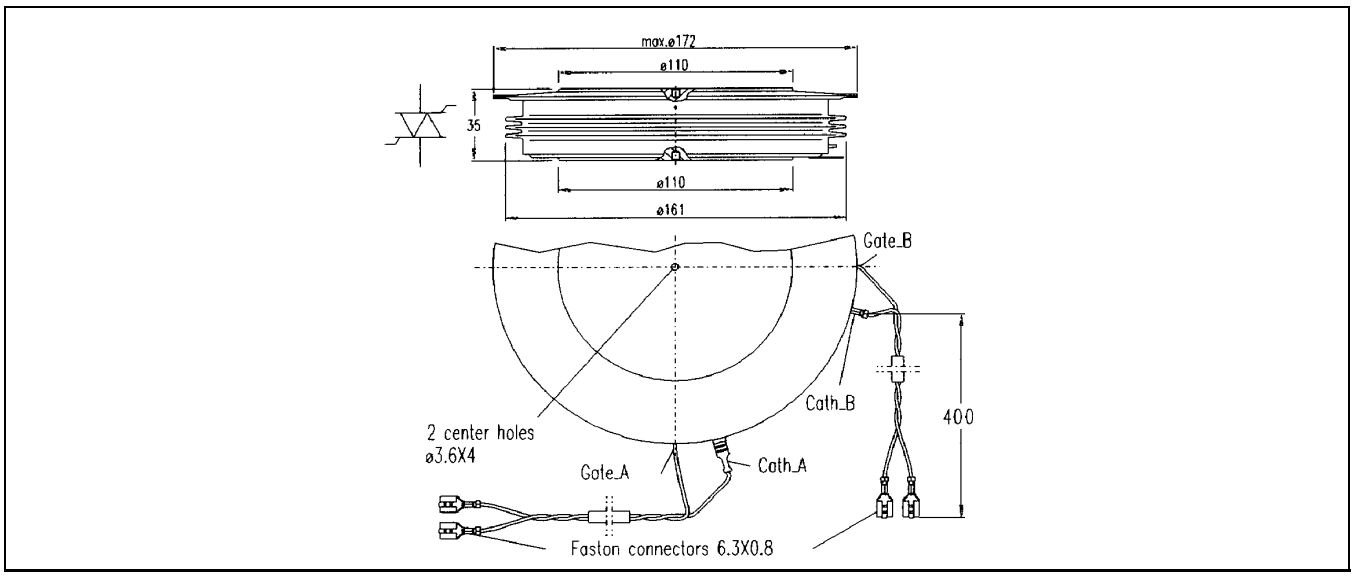

Fig. 12 Device Outline Drawing.

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