V_{DSM}	=	4200 V
I_{TAVM}	=	470 A
I_{TRMS}	=	740 A
I_{TSM}	=	6400 A
V_{T0}	=	1 V
r_T	=	1.5 mΩ

Phase Control Thyristor

5STP 04D4200

Doc. No. 5SYA1025-04 Jan. 02

- **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 04D4200	5STP 04D4000	5STP 04D3600
V_{DRM}, V_{RRM}	f = 50 Hz, t_p = 10ms	4200 V	4000 V	3600 V
V_{RSM1}	t_p = 5ms, single pulse	4600 V	4400 V	4000 V
dV/dt_{crit}	Exp. to 0.67 x V_{DRM}, T_j = 125°C	1000 V/µs		

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Forwarde leakage current	I_{DRM}	V_{DRM}, Tj = 125°C			100	mA
Reverse leakage current	I_{RRM}	V_{RRM}, Tj = 125°C			100	mA

Mechanical data

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	F_M		8	10	12	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			0.3		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

On-state

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. average on-state current	I_{TAVM}	Half sine wave, T_c = 70°C			470	A
RMS on-state current	I_{TRMS}				740	A
Max. peak non-repetitive surge current	I_{TSM}	tp = 10 ms, Tj = 125°C, V_D=V_R = 0 V			6400	A
Limiting load integral	I^2t				204	kA^2s
Max. peak non-repetitive surge current	I_{TSM}	tp = 8.3 ms, Tj = 125°C, V_D=V_R=0 V			7000	A
Limiting load integral	I^2t				203	kA^2s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_T	I_T = 500 A, T_j= 125°C			1.78	V
Threshold voltage	V_{T0}	I_T = 300 A - 1000 A, T_j= 125°C			1	V
Slope resistance	r_T	Tj = 125°C			1.5	mΩ
Holding current	I_H	T_j = 25°C			75	mA
		T_j = 125°C			60	mA
Latching current	I_L	T_j = 25°C			500	mA
		T_j = 125°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_j = 125°C, I_{TRM} = 1500 A, $V_D \le 0.67 \cdot V_{DRM}$, I_{FG} = 2 A, t_r = 0.5 µs	Cont. f = 50 Hz			100	A/µs
Critical rate of rise of on-state current	di/dt_{crit}		Cont. f = 1Hz			1000	A/µs
Circuit-commutated turn-off time	t_q	T_j = 125°C, I_{TRM} = 1500 A, V_R = 200 V, di_T/dt = -5 A/µs, $V_D \le 0.67 \cdot V_{DRM}$, dv_D/dt = 20 V/µs,		600			µs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Recovery charge	Q_{rr}	T_j = 125°C, I_{TRM} = 1500 A, V_R = 200 V, di_T/dt = -5 A/µs	800		2000	µAs
Delay time	t_d	V_D = 0.4·V_{DRM}, 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
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_j = 25°C			2.6	V
Gate trigger current	I_{GT}	T_j = 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_j				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			36	K/kW
	$R_{th(j-c)A}$	Anode side cooled			70	K/kW
	$R_{th(j-c)C}$	Cathode side cooled			74	K/kW
Thermal resistance case to heatsink	$R_{th(c-h)}$	Double side cooled			7.5	K/kW
	$R_{th(c-h)}$	Single side cooled			15	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)	19.18	9.82	5.45	1.44
τ_i(s)	0.3862	0.0561	0.0058	0.0024

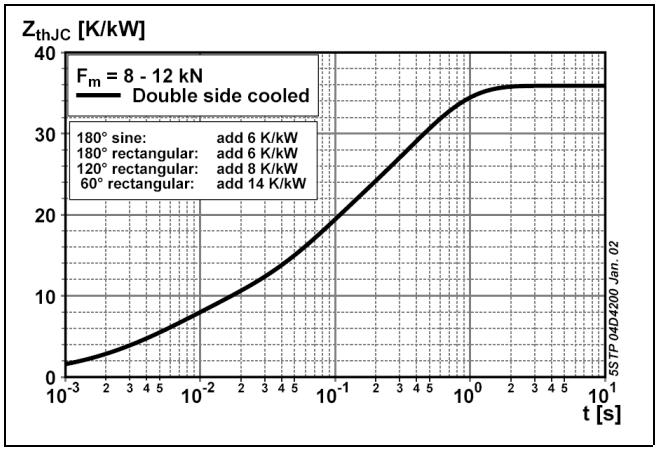

Fig. 1 Transient thermal impedance junction-to case.

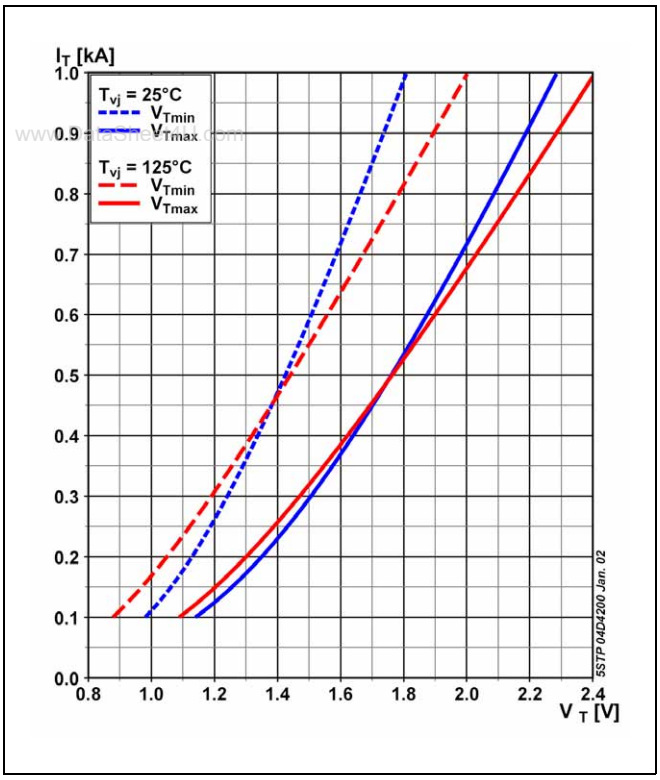

Fig. 2 On-state characteristics.

On-state characteristic model:

$$VT = A + B \cdot iT + C \cdot \ln(iT + 1) + D \cdot \sqrt{IT}$$

Valid for i_T = 100 – 6000 A

A	B	C	D
-5.9785e-1	1.5923e-3	4.1963e-1	-5.3599e-2

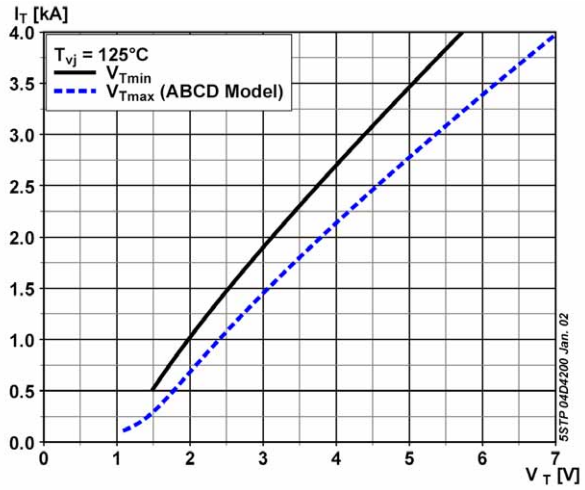

Fig. 3 On-state characteristics.
T_j=125°C, 10ms half sine

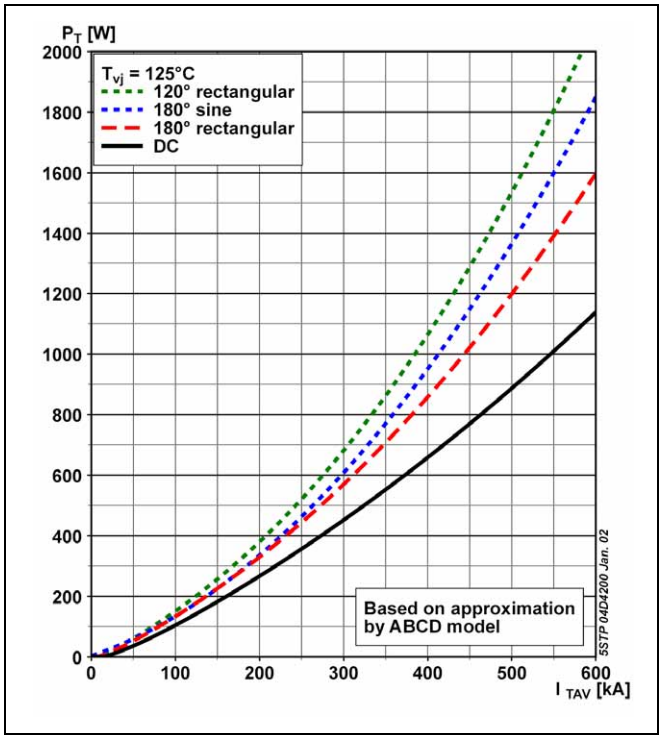

Fig. 4 On-state power dissipation vs. mean on-state current. Turn - on losses excluded.

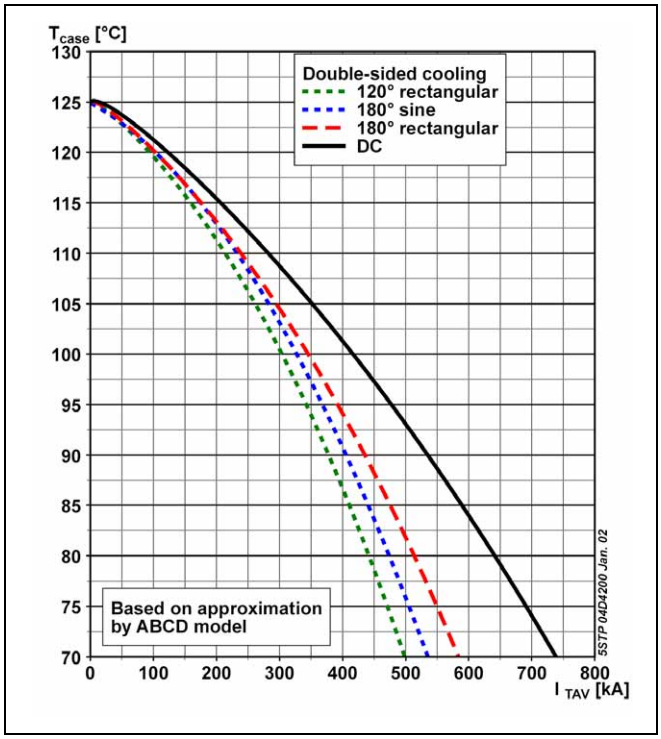

Fig. 5 Max. permissible case temperature vs. mean on-state current.

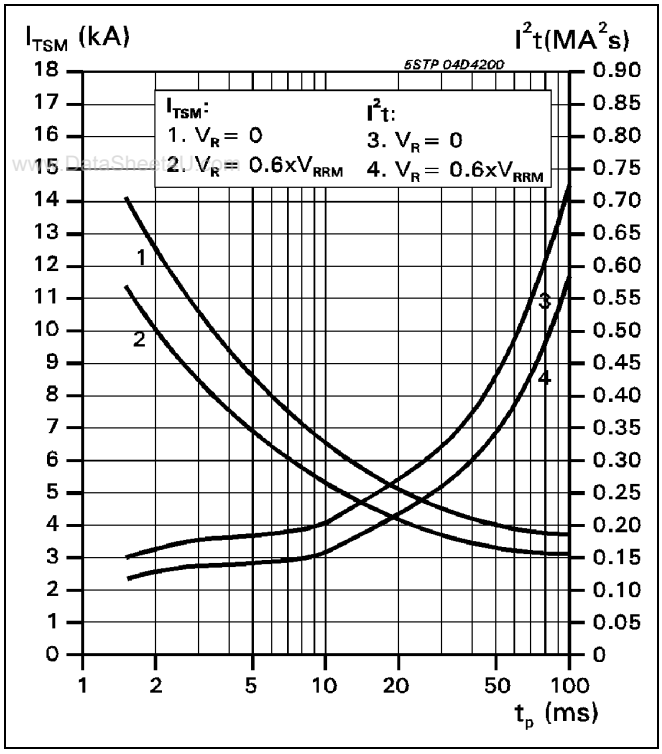

Fig. 6 Surge on-state current vs. pulse length. Half-sine wave.

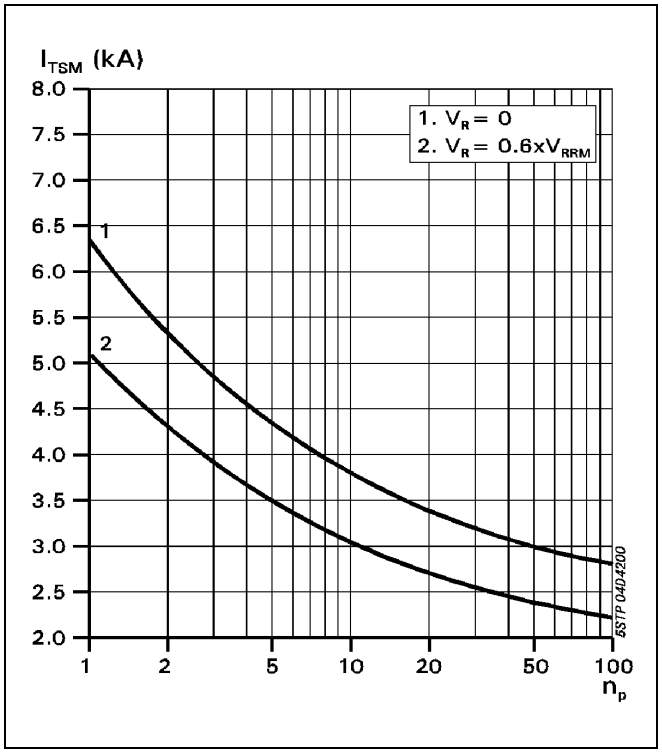

Fig. 7 Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.

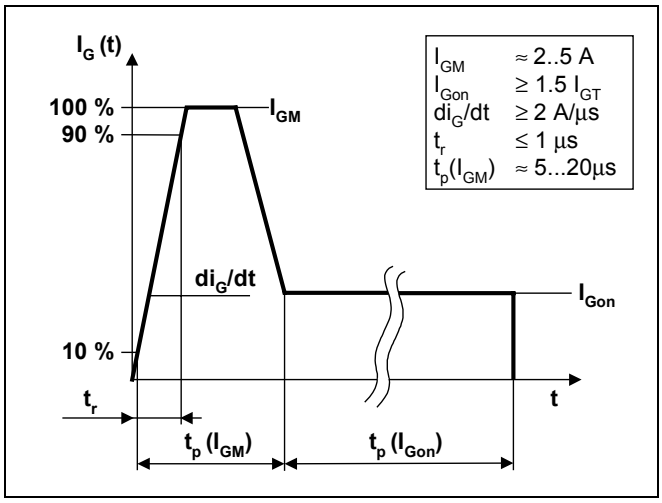

Fig. 8 Recommendet gate current waveform.

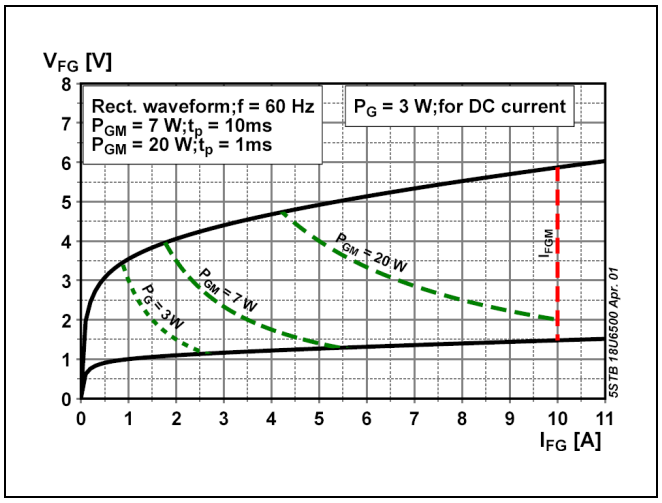

Fig. 9 Max. peak gate power loss.

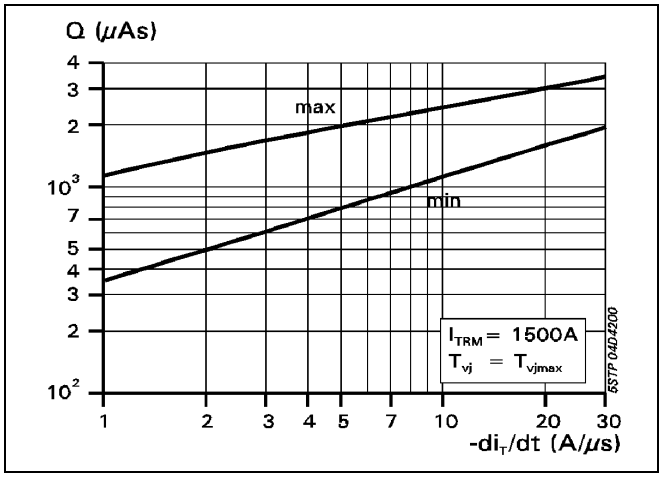

Fig. 10 Recovery charge vs. decay rate of on-state current.

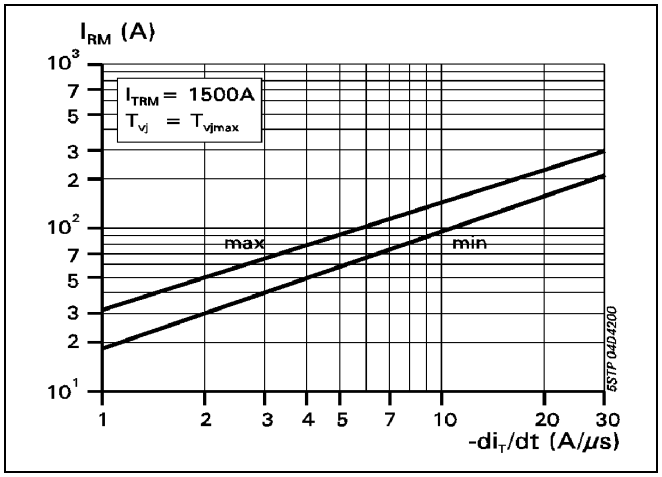

Fig. 11 Peak reverse recovery current vs. decay rate of on-state current.

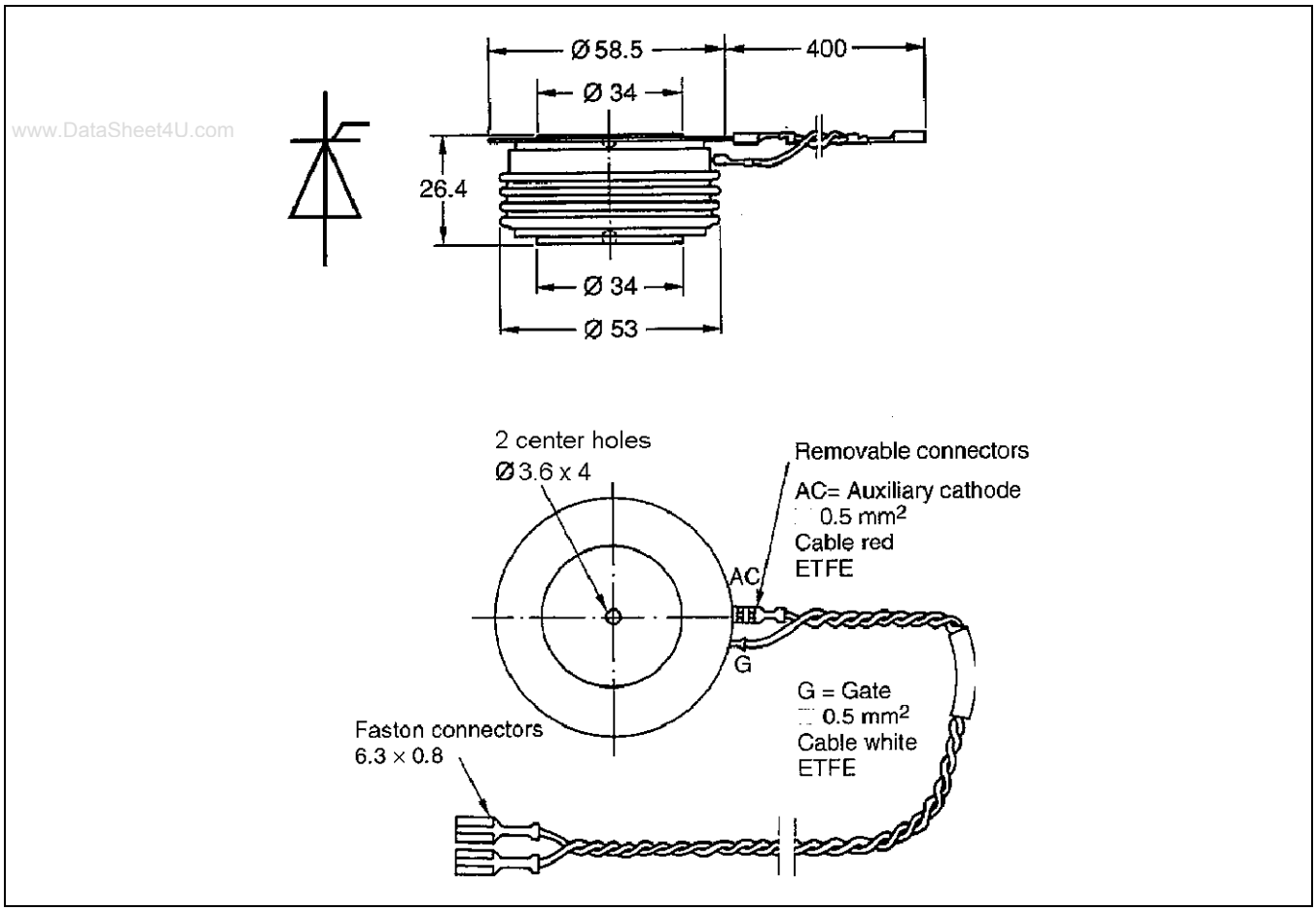

Fig. 12 Device Outline Drawing.

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