V_{RRM}	=	4500 V
$I_{F(AV)M}$	=	2620 A
I_{FSM}	=	$56 \cdot 10^3$ A
V_{F0}	=	1.10 V
r_F	=	0.47 mΩ
$V_{DC\text{-}Link}$	=	2800 V

Fast Recovery Diode

5SDF 28L4520

Doc. No. 5SYA1185-03 Jan. 17

- **Industry standard housing**
- **Cosmic radiation withstand rating**
- **Optimized low on-state**
- **Optimized for snubberless operation**
- **High RBSOA upto high di/dt**

Blocking

Maximum rated values [1)]

Parameter	Symbol	Conditions		5SDF 28L4520	Unit
Repetitive peak reverse voltage	V_{RRM}	f = 50 Hz, t_p = 10 ms, T_{vj} = 140 °C		4500	V
Permanent DC voltage for 100 FIT failure rate	$V_{DC\text{-}link}$	Ambient cosmic radiation at sea level in open air.	100% Duty	2800	V
			5% Duty	3200	

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Reverse leakage current	I_{RRM}	V_{RRM}, T_{vj} = 140 °C			120	mA

Mechanical data

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	F_M		36	40	70	kN
Acceleration	a	Device unclamped			50	m/s^2
Acceleration	a	Device clamped			200	m/s^2

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Weight	m				1.45	kg
Housing thickness	H	F_M = 40 kN, T_a = 25 °C	25.4		25.8	mm
Surface creepage distance	D_S		33			mm
Air strike distance	D_a		14			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	$I_{F(AV)M}$	Half sine wave, Tc = 70 °C			2620	A
RMS on-state current	$I_{F(RMS)}$				4120	A
Peak non-repetitive surge current	I_{FSM}	t_p = 10 ms, T_{vj} = 140 °C, sine half wave, V_R = 0 V, after surge			$56 \cdot 10^3$	A
Limiting load integral	I^2t				$15.7 \cdot 10^6$	A^2s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_F	I_F = 3300 A, T_{vj} = 140 °C		2.3	2.6	V
Threshold voltage	V_{F0}	500...4000, T_{vj} = 140 °C			1.10	V
Slope resistance	r_F				0.47	mΩ

Turn-on

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Peak forward recovery voltage	V_{FRM}	dI_F/dt = 3000 A/µs, I_{FM} = 5500 A, T_{vj} = 140 °C		190		V

Turn-off

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. decay rate of on-state current	di/dt_{crit}	I_{FM} = 5500 A, T_{vj} = 140 °C, $V_{DC\text{-}Link}$ = 2800 V			1000	A/µs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Reverse recovery charge	Q_{rr}	I_{FQ} = 3300 A, $V_{DC\text{-}Link}$ = 2800 V, $-di_F/dt$ = 1000 A/µs, L_{CL} = 300 nH, C_{CL} = 20 µF, R_{CL} = 0.3 Ω, D_{CL} = 5SDF 10H4503, T_{vj} = 140 °C		10000	10900	µAs
Reverse recovery current	I_{RM}			2500	2800	A
Turn-off energy	E_{rr}			23	27.44	J

Thermal

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Operating junction temperature range	T_{vj}		0		140	°C
Storage temperature range	T_{stg}		-40		125	°C

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Thermal resistance junction to case	$R_{th(j-c)}$	Double-side cooled F_m = 36... 70 kN			6	K/kW
	$R_{th(j-c)A}$	Anode-side cooled F_m = 36... 70 kN			11.2	K/kW
	$R_{th(j-c)C}$	Cathode-side cooled F_m = 36... 70 kN			12.9	K/kW
Thermal resistance case to heatsink	$R_{th(c-h)}$	Double-side cooled F_m = 36... 70 kN			3	K/kW
	$R_{th(c-h)}$	Single-side cooled F_m = 36... 70 kN			6	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)	3.708	1.426	0.686	0.176
τ_i(s)	0.5336	0.0670	0.0074	0.0011

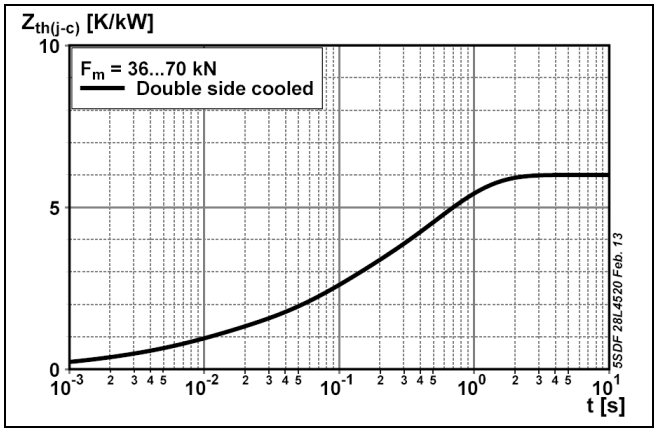

Fig. 1 Transient thermal impedance (junction-to-case) vs. time

Max. on-state characteristic model:

$$V_{F25} = A_{Tvj} + B_{Tvj} \cdot I_F + C_{Tvj} \cdot \ln(I_F + 1) + D_{Tvj} \cdot \sqrt{I_F}$$

Valid for I_F = 200 - 48000 A

A_{25}	B_{25}	C_{25}	D_{25}
$364.10 \cdot 10^{-3}$	$235.80 \cdot 10^{-6}$	$116.1 \cdot 10^{-3}$	$7.92 \cdot 10^{-3}$

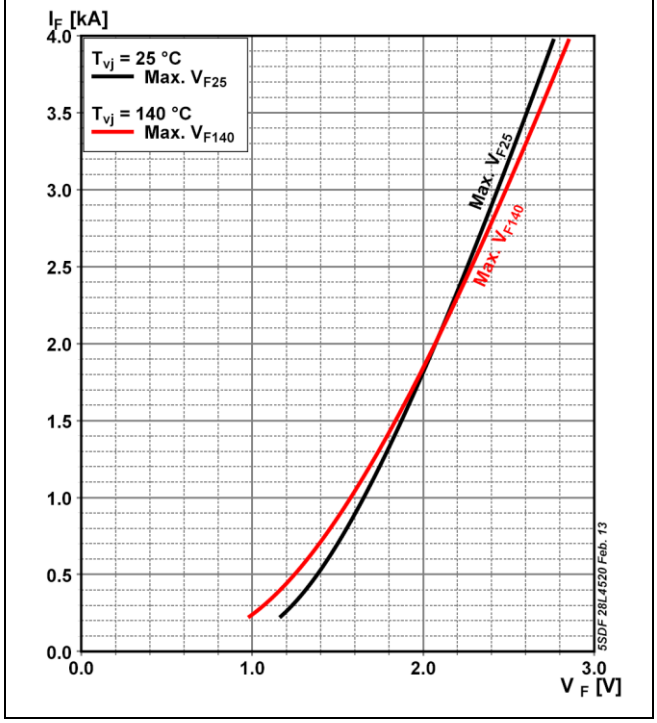

Fig. 2 On-state voltage characteristics

Max. on-state characteristic model:

$$V_{F140} = A_{Tvj} + B_{Tvj} \cdot I_F + C_{Tvj} \cdot \ln(I_F + 1) + D_{Tvj} \cdot \sqrt{I_F}$$

Valid for I_F = 200 - 48000 A

A_{140}	B_{140}	C_{140}	D_{140}
$40.96 \cdot 10^{-3}$	$220.50 \cdot 10^{-6}$	$125.10 \cdot 10^{-3}$	$14.23 \cdot 10^{-3}$

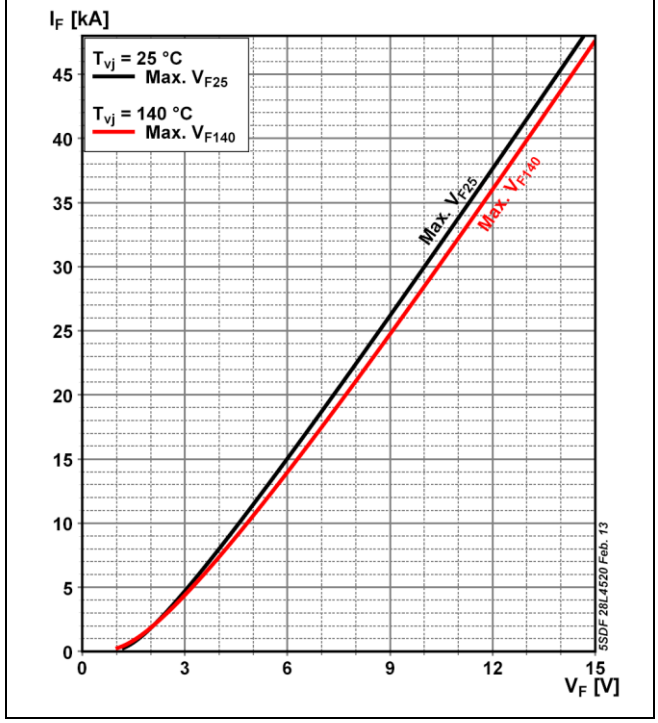

Fig. 3 On-state voltage characteristics

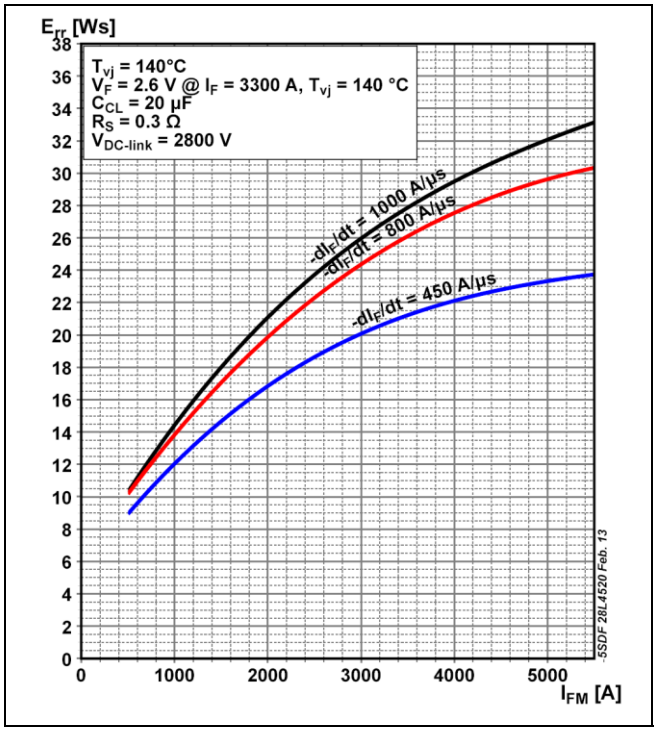

Fig. 4 Upper scatter range of turn-off energy per pulse vs. turn-off current

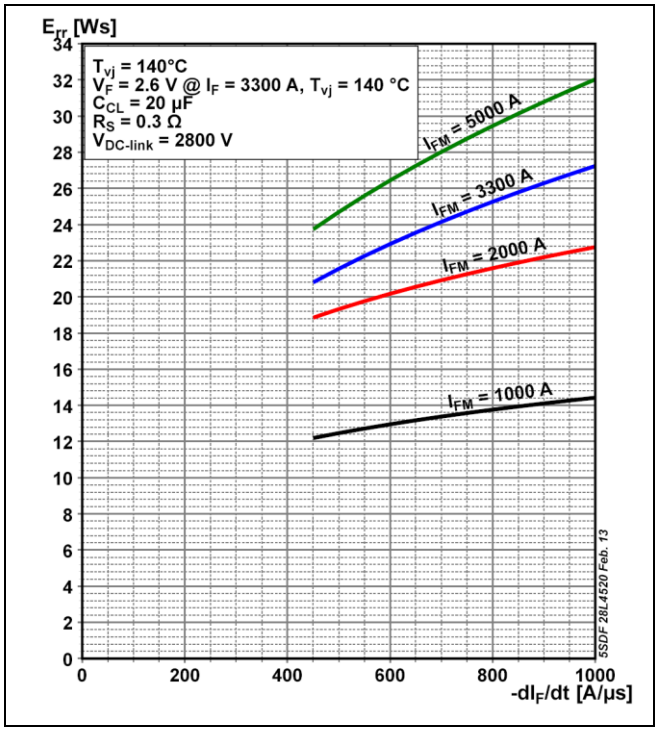

Fig. 5 Upper scatter range of turn-off energy per pulse vs reverse current rise rate

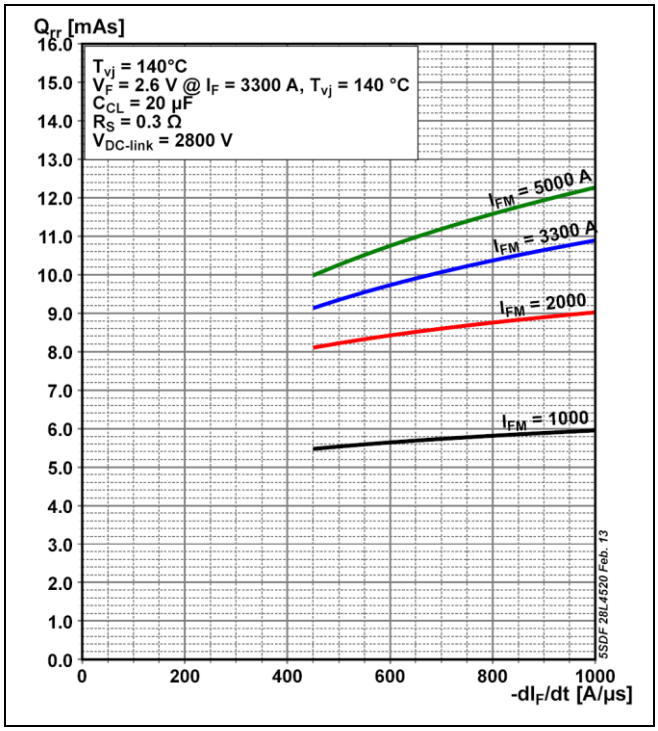

Fig. 6 Upper scatter range of repetitive reverse recovery charge vs reverse current rise rate.

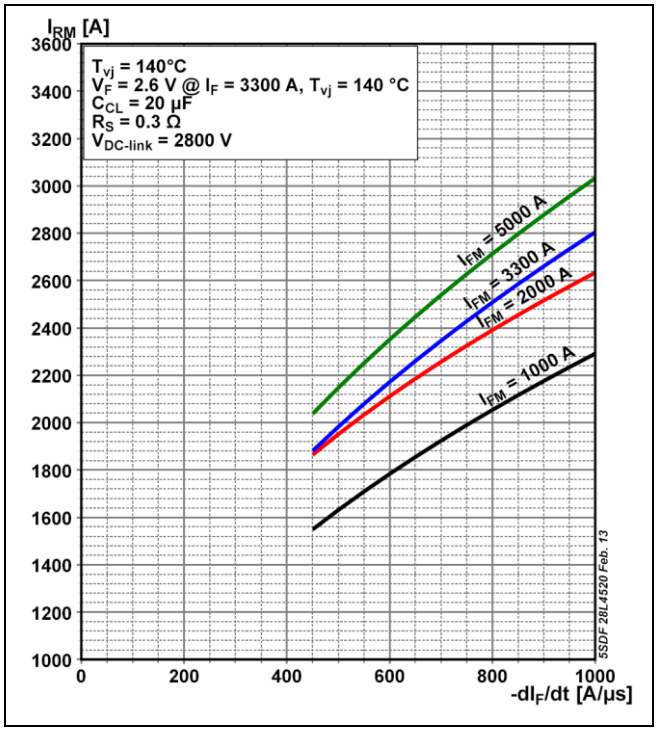

Fig. 7 Upper scatter range of reverse recovery current vs reverse current rise rate

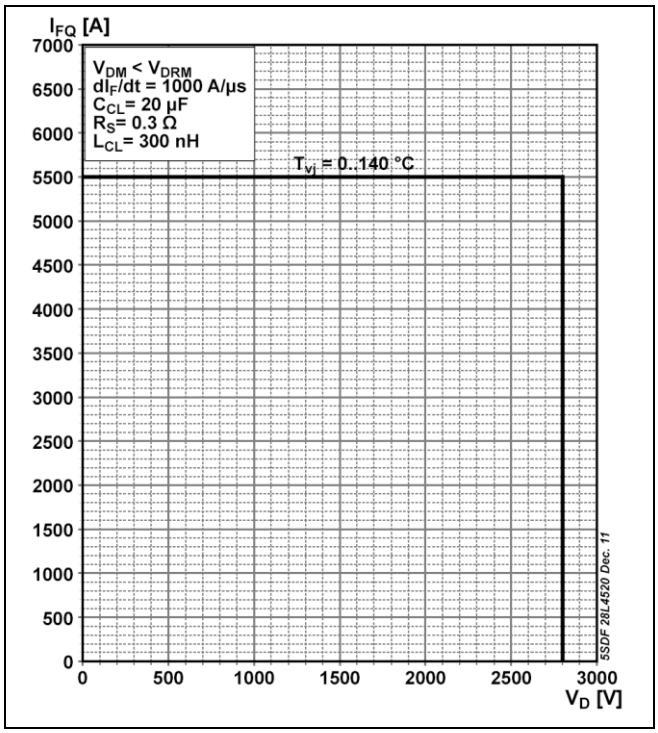

Fig. 8 Diode Safe Operating Area

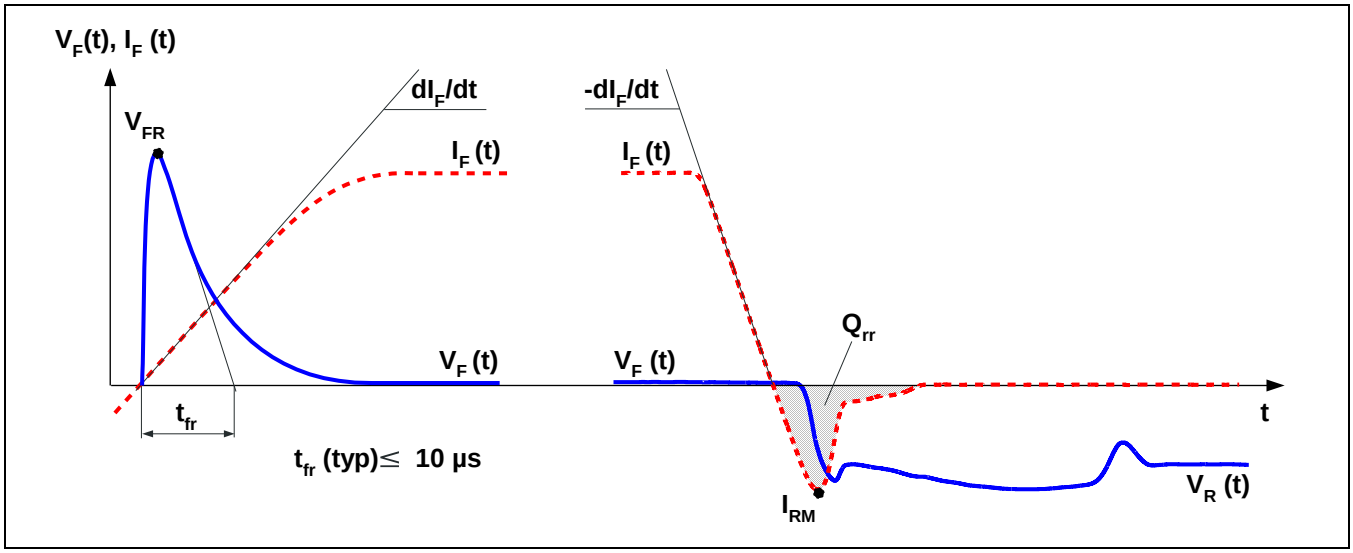

Fig. 9 General current and voltage waveforms

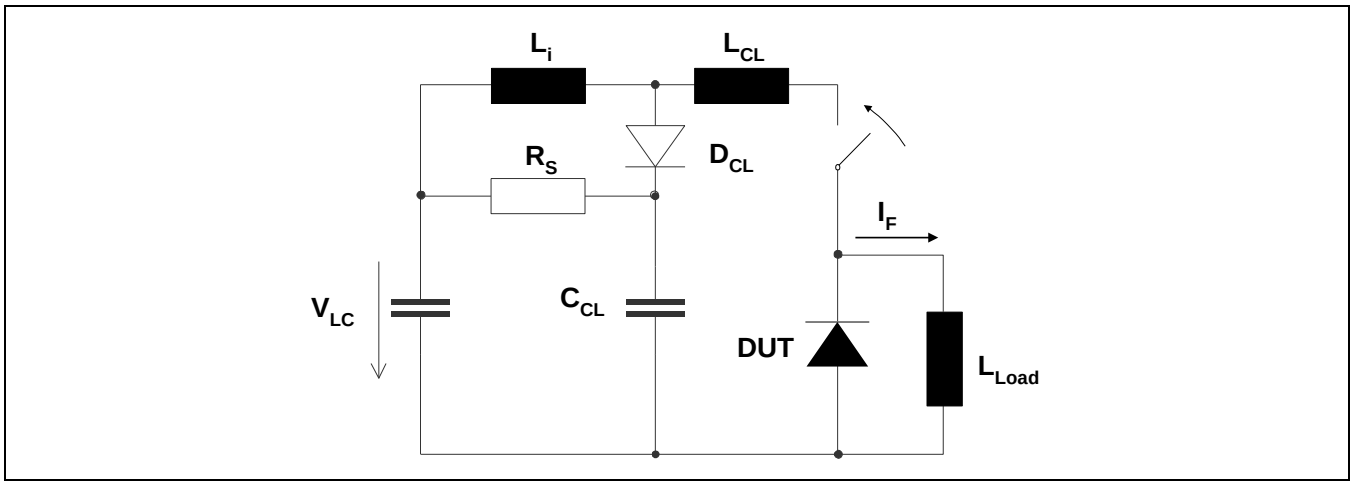

Fig. 10 Test circuit.

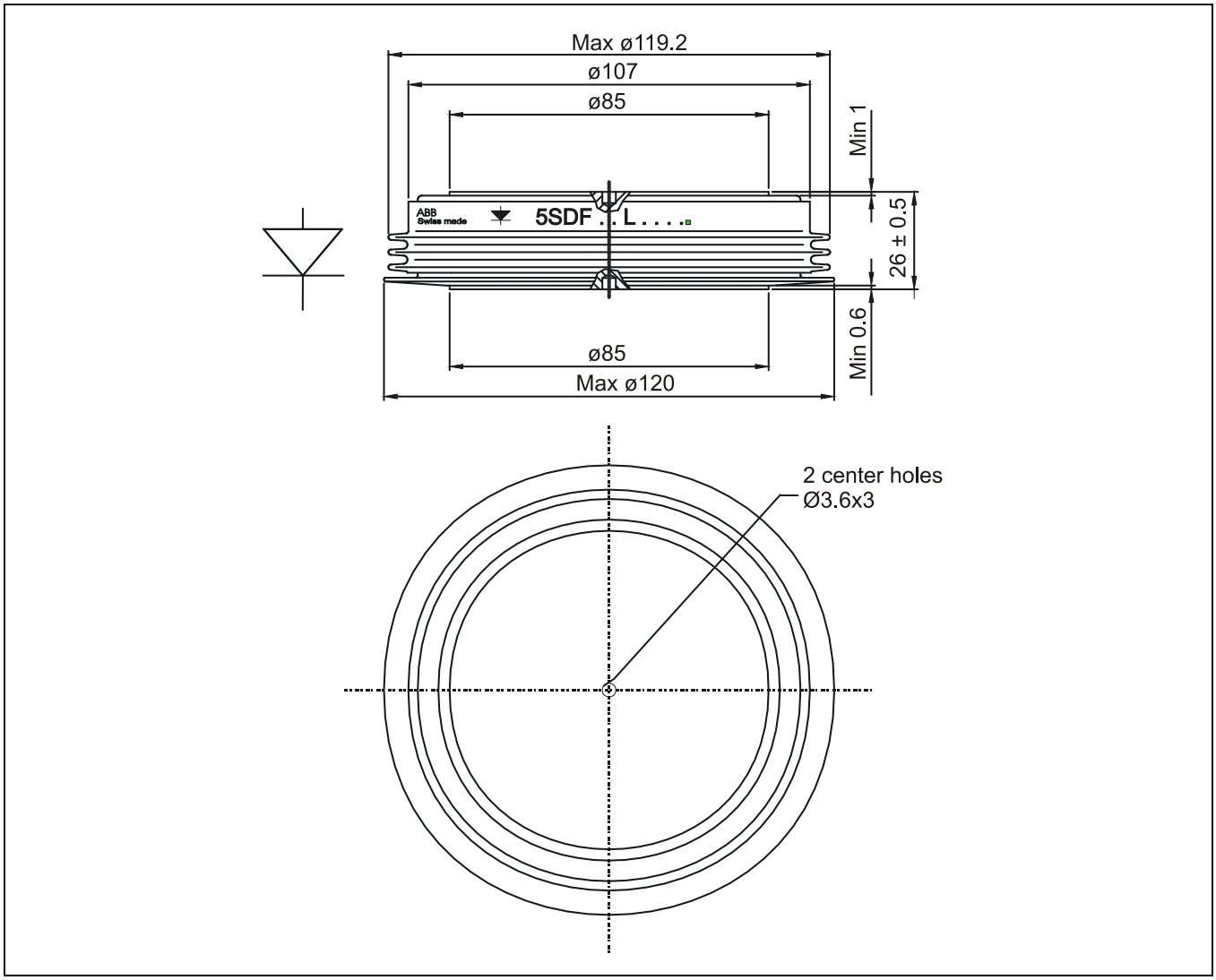

Fig. 11 Device Outline Drawing

Related documents:

Doc. Nr.	Title
5SYA 2036	Recommendations regarding mechanical clamping of Press Pack High Power Semiconductors
5SYA 2064	Applying Fast Recovery Diodes
5SZK 9104	Specification of environmental class for pressure contact diodes, PCTs and GTO, STORAGE
5SZK 9105	Specification of environmental class for pressure contact diodes, PCTs and GTO, TRANSPORTATION
5SZK 9115	Specification of environmental class for presspack Diodes, PCTs and GTOs, OPERATION (Industry)
5SZK 9116	Specification of environmental class for presspack Diodes, PCTs and GTOs, OPERATION (Traction)

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