

$V_{RSM}$	=	4000 V
$I_{F(AV)M}$	=	5200 A
$I_{F(RMS)}$	=	8200 A
$I_{FSM}$	=	$85 \times 10^3$ A
$V_{F0}$	=	0.8 V
$r_F$	=	0.086 m $\Omega$

# Rectifier Diode

## 5SDD 54N4000

Doc. No. 5SYA1171-00 Dec. 03

- Patented free-floating silicon technology
- Very low on-state losses
- Optimum power handling capability

### Blocking

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

Parameter	Symbol	Conditions	Value	Unit
Repetitive peak reverse voltage	$V_{RRM}$	$f = 50$ Hz, $t_p = 10$ ms, $T_j = 0 \dots 150^\circ\text{C}$	3600	V
Non - repetitive peak reverse voltage	$V_{RSM}$	$f = 5$ Hz, $t_p = 10$ ms, $T_j = 0 \dots 150^\circ\text{C}$	4000	V

#### Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. (reverse) leakage current	$I_{RRM}$	$V_{RRM}$ , $T_j = 150^\circ\text{C}$			400	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				2.8	kg
Housing thickness	H	$F_M = 90$ kN, $T_a = 25^\circ\text{C}$			35.9	mm
Surface creepage distance	$D_S$		56			mm
Air strike distance	$D_a$		22			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
Max. average on-state current	$I_{F(AV)M}$	50 Hz, Half sine wave, $T_C = 85^\circ\text{C}$			5200	A
Max. RMS on-state current	$I_{F(RMS)}$				8200	A
Max. peak non-repetitive surge current	$I_{FSM}$	$t_p = 10\text{ ms}$ , $T_j = 150^\circ\text{C}$ , $V_R = 0\text{ V}$			$85 \times 10^3$	A
Limiting load integral	$I^2t$				$36.3 \times 10^6$	$\text{A}^2\text{s}$
Max. peak non-repetitive surge current	$I_{FSM}$	$t_p = 8.3\text{ ms}$ , $T_j = 150^\circ\text{C}$ , $V_R = 0\text{ V}$			$90 \times 10^3$	A
Limiting load integral	$I^2t$				$34.6 \times 10^6$	$\text{A}^2\text{s}$

### Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	$V_F$	$I_F = 5000\text{ A}$ , $T_j = 150^\circ\text{C}$			1.23	V
Threshold voltage	$V_{(T0)}$	$T_j = 150^\circ\text{C}$			0.8	V
Slope resistance	$r_T$	$I_T = 2500 \dots 7500\text{ A}$			0.086	$\text{m}\Omega$

## Switching

### Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Recovery charge	$Q_{rr}$	$di_F/dt = -10\text{ A}/\mu\text{s}$ , $V_R = 200\text{ V}$ $I_{FRM} = 4000\text{ A}$ , $T_j = 150^\circ\text{C}$			18000	$\mu\text{As}$

# Thermal

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

Parameter	Symbol	Conditions	min	typ	max	Unit
Operating junction temperature range	T <sub>vj</sub>		0		150	°C
Storage temperature range	T <sub>stg</sub>		-40		150	°C

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Thermal resistance junction to case	R <sub>th(j-c)</sub>	Double-side cooled F <sub>m</sub> = 81...108 kN			5.7	K/kW
	R <sub>th(j-c)A</sub>	Anode-side cooled F <sub>m</sub> = 81...108 kN			11.4	K/kW
	R <sub>th(j-c)C</sub>	Cathode-side cooled F <sub>m</sub> = 81...108 kN			11.4	K/kW
Thermal resistance case to heatsink	R <sub>th(c-h)</sub>	Double-side cooled F <sub>m</sub> = 81...108 kN			1	K/kW
	R <sub>th(c-h)</sub>	Single-side cooled F <sub>m</sub> = 81...108 kN			2	K/kW

Analytical function for transient thermal impedance:

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

i	1	2	3	4
R <sub>th i</sub> (K/kW)	3.728	1.248	0.433	0.292
τ <sub>i</sub> (s)	0.8115	0.1014	0.0089	0.0015

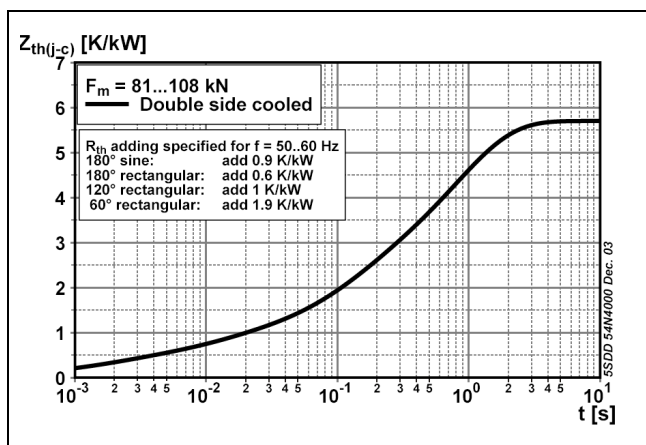


Fig. 1 Transient thermal impedance junction-to-case.

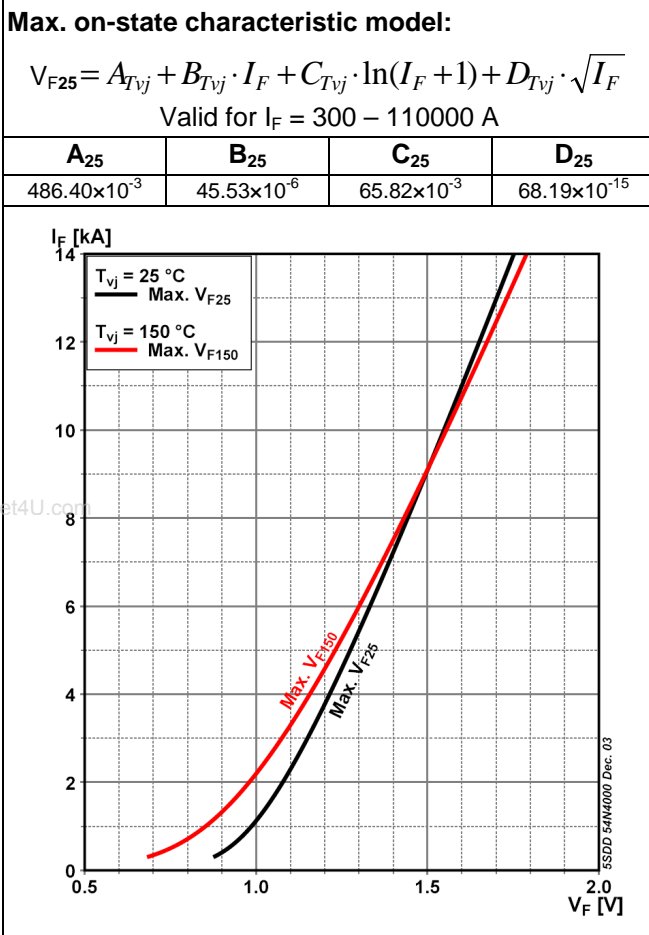


Fig. 2 Isothermal on-state characteristics

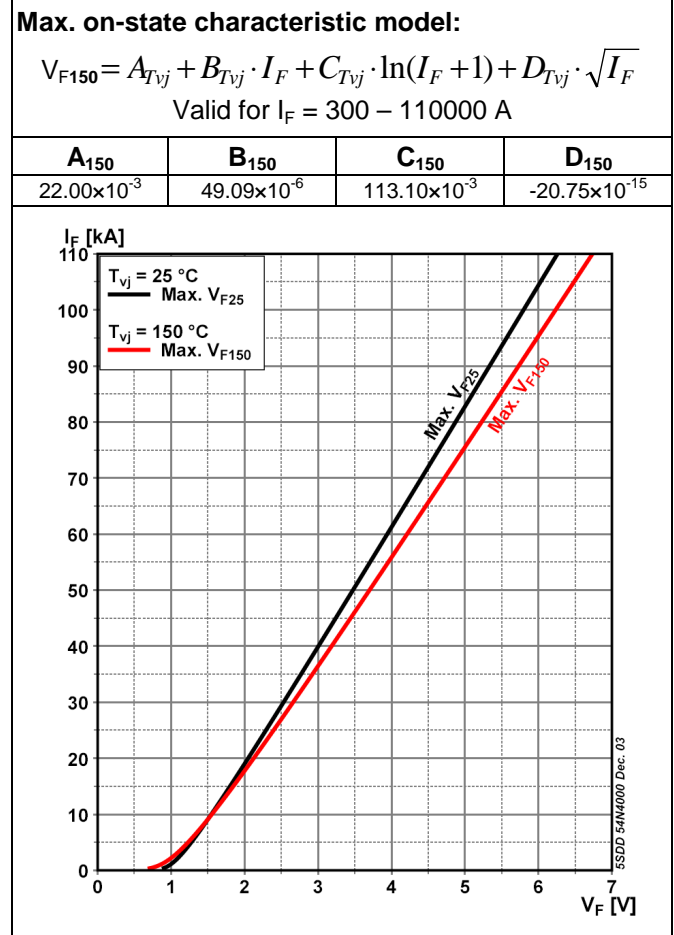


Fig. 3 Isothermal on-state characteristics

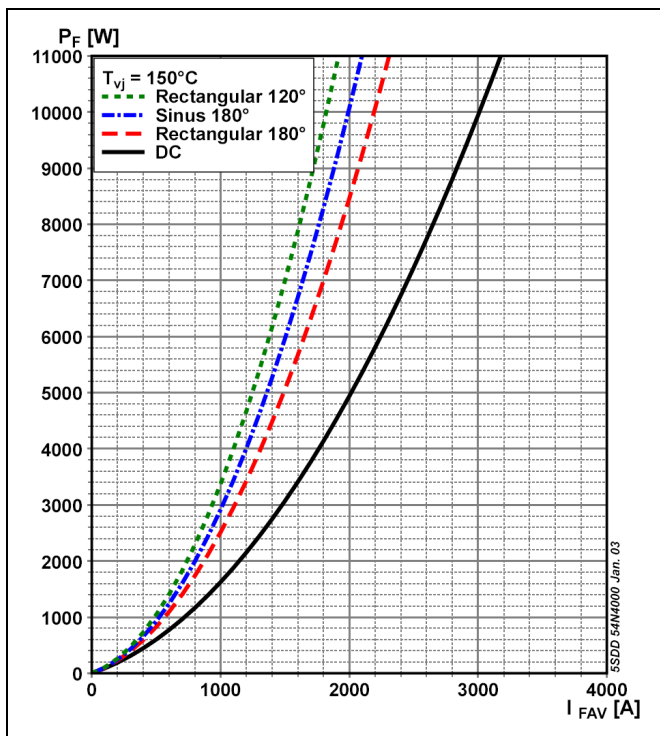


Fig. 4 On-state power losses vs average on-state current.

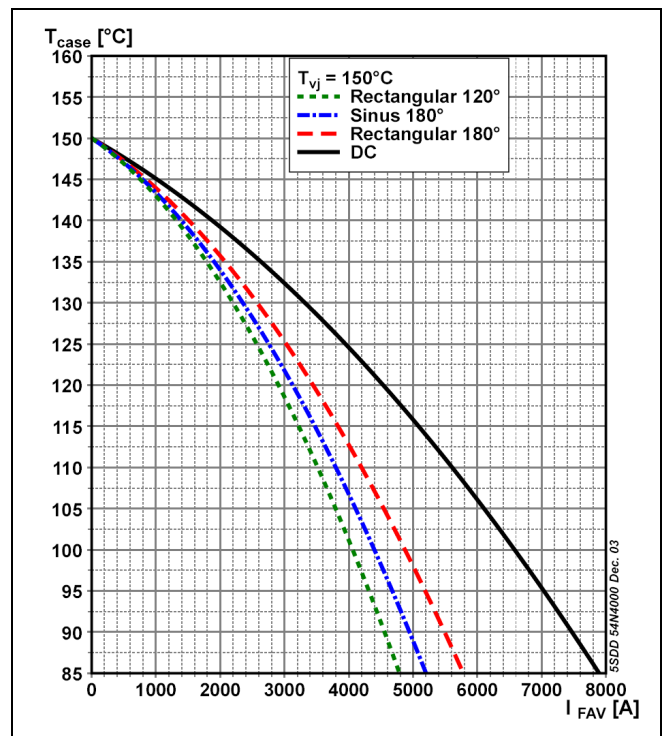
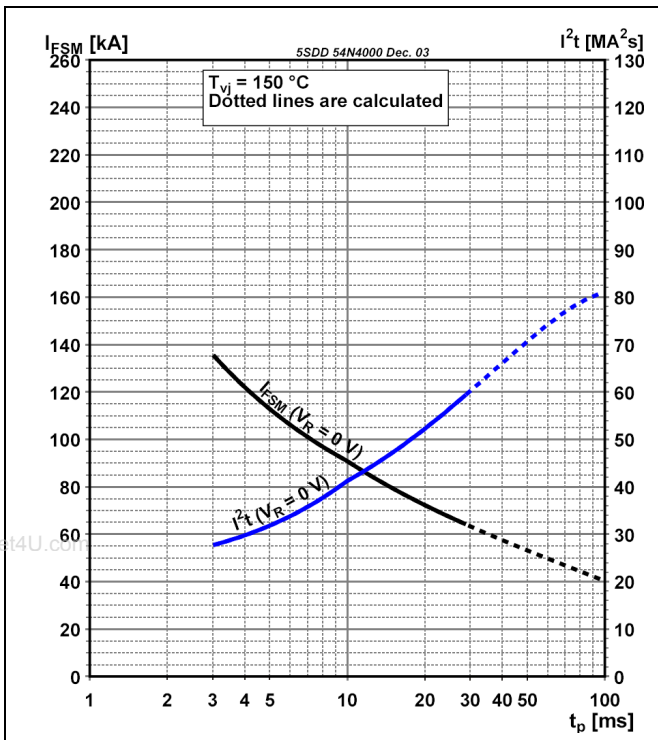
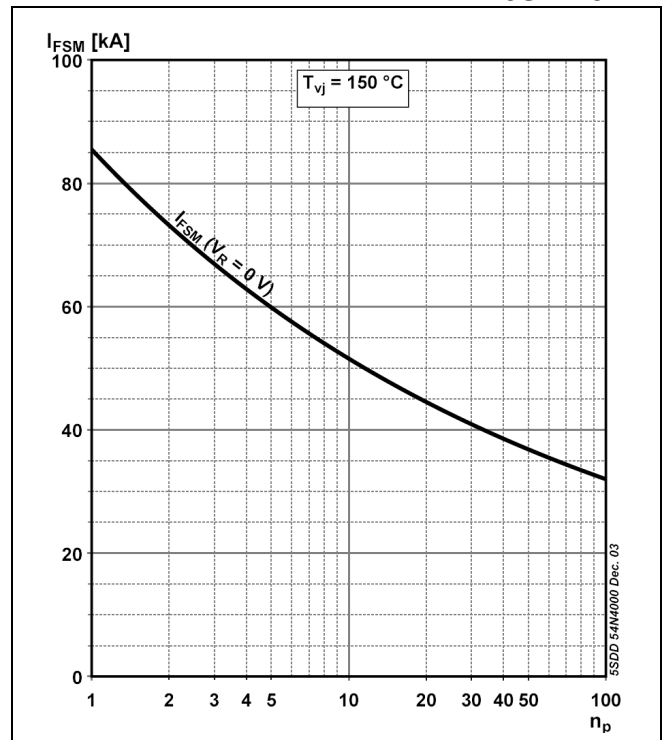


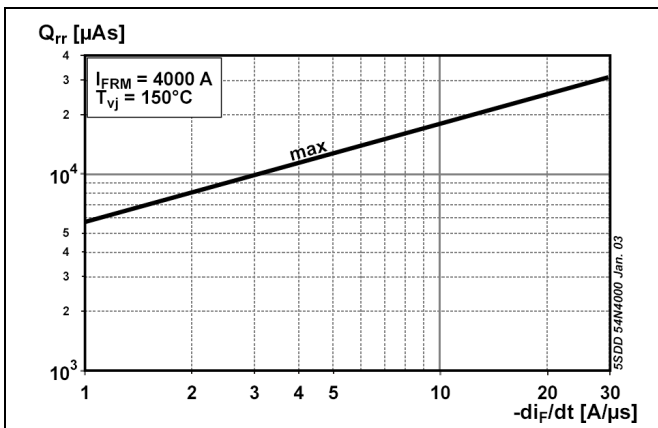
Fig. 5 Max. permissible case temperature vs average on-state current.



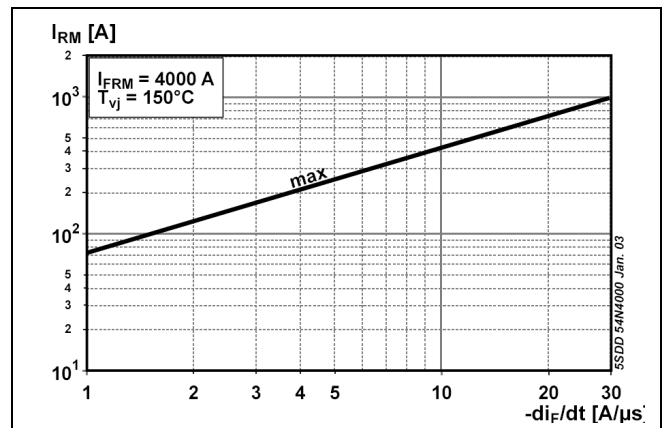
**Fig. 6** Surge on-state current vs. pulse length. Half-sine wave.



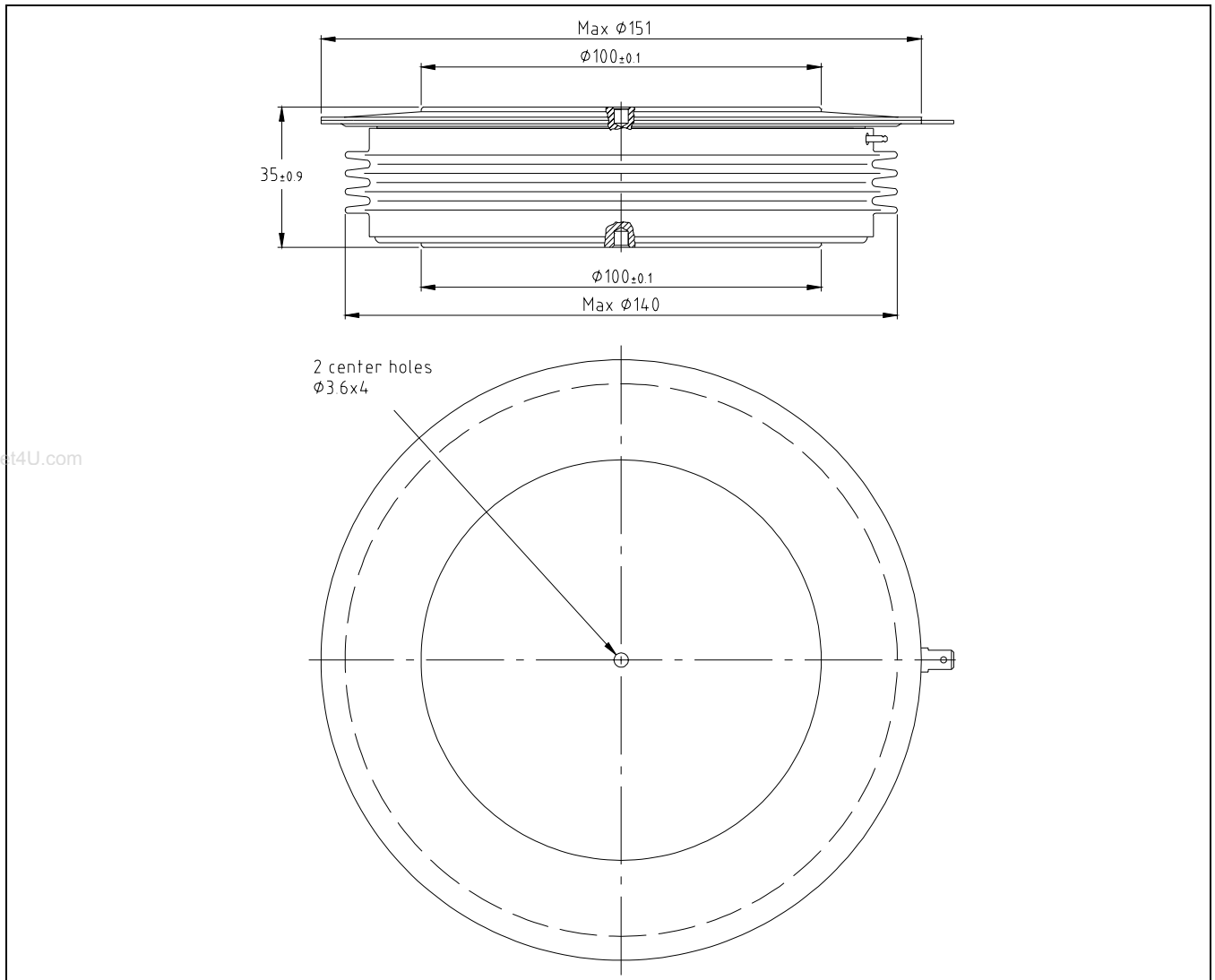
**Fig. 7** Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.



**Fig. 8** Recovery charge vs. decay rate of on-state current.



**Fig. 9** Peak reverse recovery current vs. decay rate of on-state current.



**Fig. 10** Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise.

### Related application notes:

Doc. Nr	Titel
5SYA 2020	Design of RC-Snubbers for Phase Control Applications
5SYA 2029	Designing Large Rectifiers with High Power Diodes
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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