

$V_{RRM}$	=	4500 V
$I_{F(AV)M}$	=	2070 A
$I_{FSM}$	=	$45 \cdot 10^3$ A
$V_{F0}$	=	1.56 V
$r_F$	=	0.80 m $\Omega$
$V_{DC-Link}$	=	2800 V

## Fast Recovery Diode

# 5SDF 20L4521

## Preliminary

Doc. No. 5SYA1186-03 Jun. 19

- Industry standard housing
- Cosmic radiation withstand rating
- Optimized low switching losses
- Optimized for IGBT operation
- High RBSOA up to high di/dt

### Blocking

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

Parameter	Symbol	Conditions	5SDF 20L4521	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	$V_{DC-link}$	Ambient cosmic radiation at sea level in 100% Duty	2800	V
		open air. 5% Duty	3200	

*Characteristic values*

Parameter	Symbol	Conditions	min	typ	max	Unit
Reverse leakage current	$I_{RRM}$	$V_{RRM}$ , $T_{vj} = 140$ °C			150	mA

### Mechanical data

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

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

*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	25.85		26.25	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

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## On-state

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

Parameter	Symbol	Conditions	min	typ	max	Unit
Average on-state current	$I_{F(AV)M}$	Half sine wave, $T_c = 70\text{ °C}$			2070	A
RMS on-state current	$I_{F(RMS)}$				3250	A
Peak non-repetitive surge current	$I_{FSM}$	$t_p = 10\text{ ms}$ , $T_{vj} = 140\text{ °C}$ , sine half wave, $V_R = 0\text{ V}$ , after surge			$45 \cdot 10^3$	A
Limiting load integral	$I^2t$				$10.1 \cdot 10^6$	$A^2s$

### Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	$V_F$	$I_F = 3300\text{ A}$ , $T_{vj} = 140\text{ °C}$		3.69	4.2	V
Threshold voltage	$V_{F0}$	$I_F = 500 \dots 3500\text{ A}$ , $T_{vj} = 140\text{ °C}$			1.56	V
Slope resistance	$r_F$				0.80	$m\Omega$

## Turn-on

### Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Peak forward recovery voltage	$V_{FRM}$	$di/dt = 3000\text{ A}/\mu s$ , $I_{FM} = 5500\text{ A}$ , $T_{vj} = 140\text{ °C}$		200		V

## Turn-off

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

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. decay rate of on-state current	$di/dt_{crit}$				TBD	$A/\mu s$

### Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit	
Reverse recovery charge	$Q_{rr}$	$I_F = 3000\text{ A}$ , $V_{DC-Link} = 2800\text{ V}$ , $di/dt = 5000\text{ A}/\mu s$ , $L_\sigma = 200\text{ nH}$ , IGBT = 5SNA 2000K450300, $T_{vj} = 140\text{ °C}$ , $V_{GE} = \pm 15\text{ V}$		5200	6400	$\mu As$	
Reverse recovery current	$I_{RM}$				3500	4300	A
Turn-off energy	$E_{rr}$				10.0	12.4	J

# Thermal

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

Parameter	Symbol	Conditions	min	typ	max	Unit
Operating junction temperature range	T <sub>vj</sub>				140	°C
Storage temperature range	T <sub>stg</sub>		-40		125	°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> = 36... 70 kN			6	K/kW
	R <sub>th(j-c)A</sub>	Anode-side cooled F <sub>m</sub> = 36... 70 kN			11.2	K/kW
	R <sub>th(j-c)C</sub>	Cathode-side cooled F <sub>m</sub> = 36... 70 kN			12.9	K/kW
Thermal resistance case to heatsink	R <sub>th(c-h)</sub>	Double-side cooled F <sub>m</sub> = 36... 70 kN			3	K/kW
	R <sub>th(c-h)</sub>	Single-side cooled F <sub>m</sub> = 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 <sub>i</sub> (K/kW)	3.708	1.426	0.686	0.176
τ <sub>i</sub> (s)	0.5336	0.0670	0.0074	0.0011

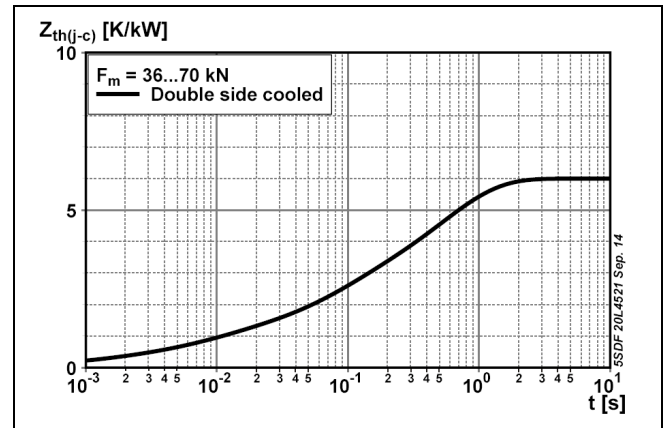
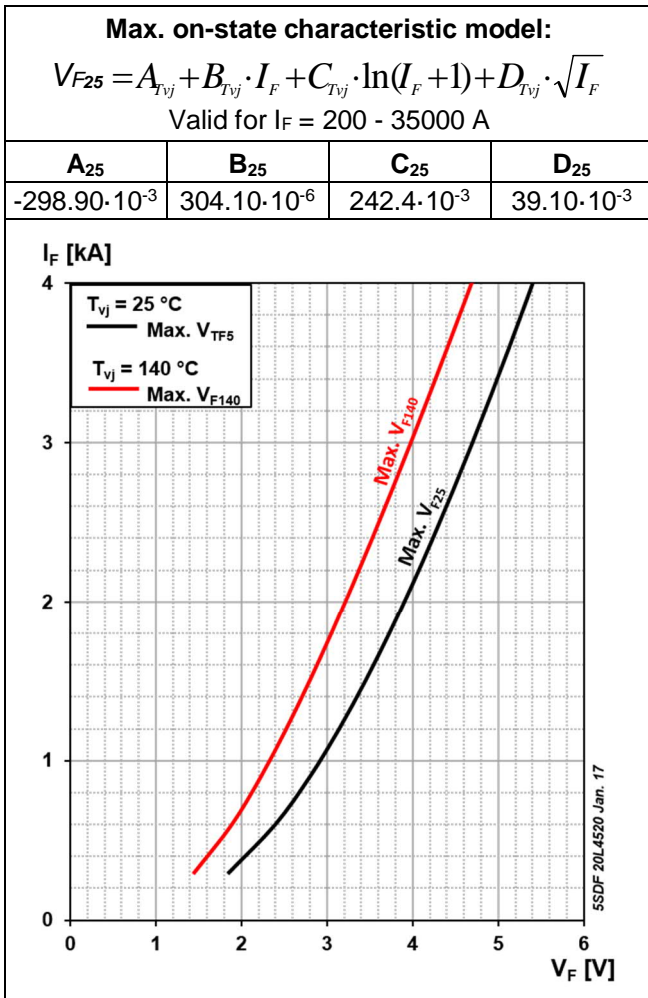
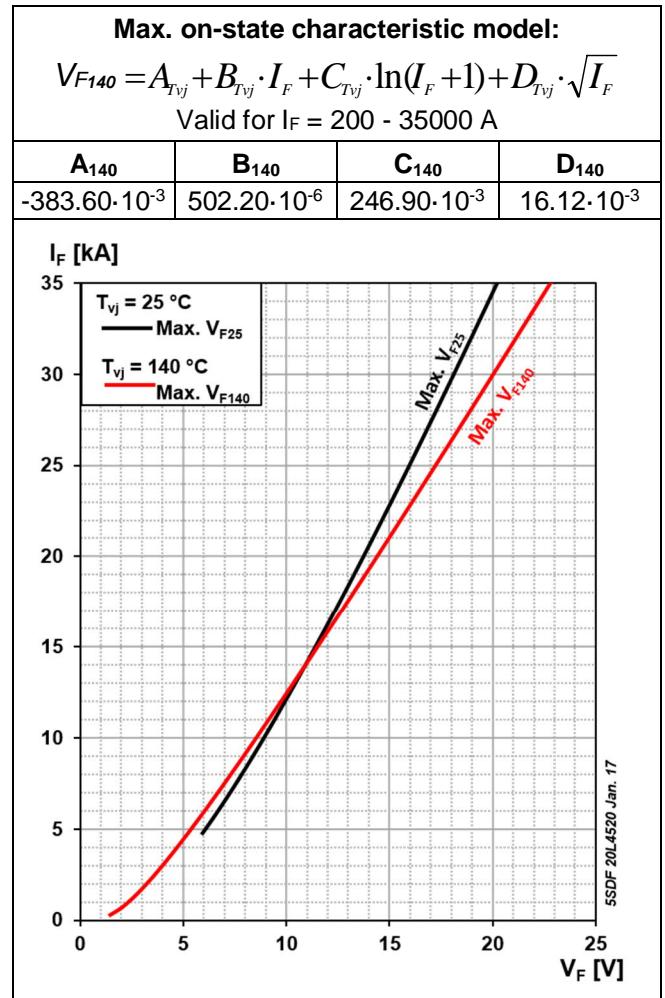


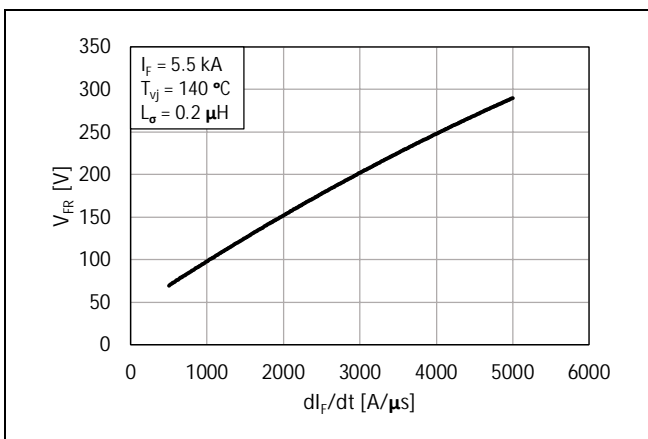
Fig. 1 Transient thermal impedance (junction-to-case) vs. time



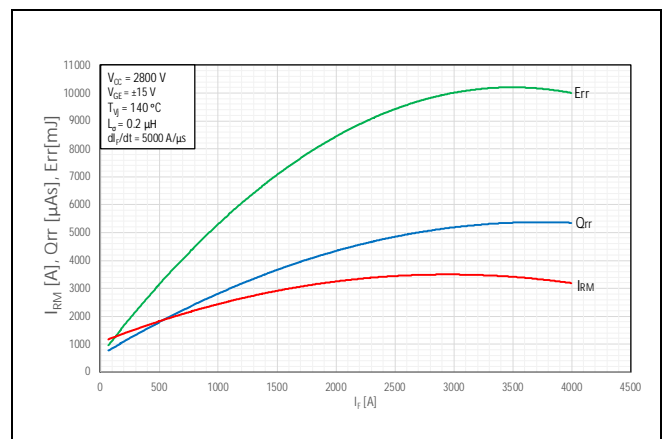
**Fig. 2** On-state voltage characteristics



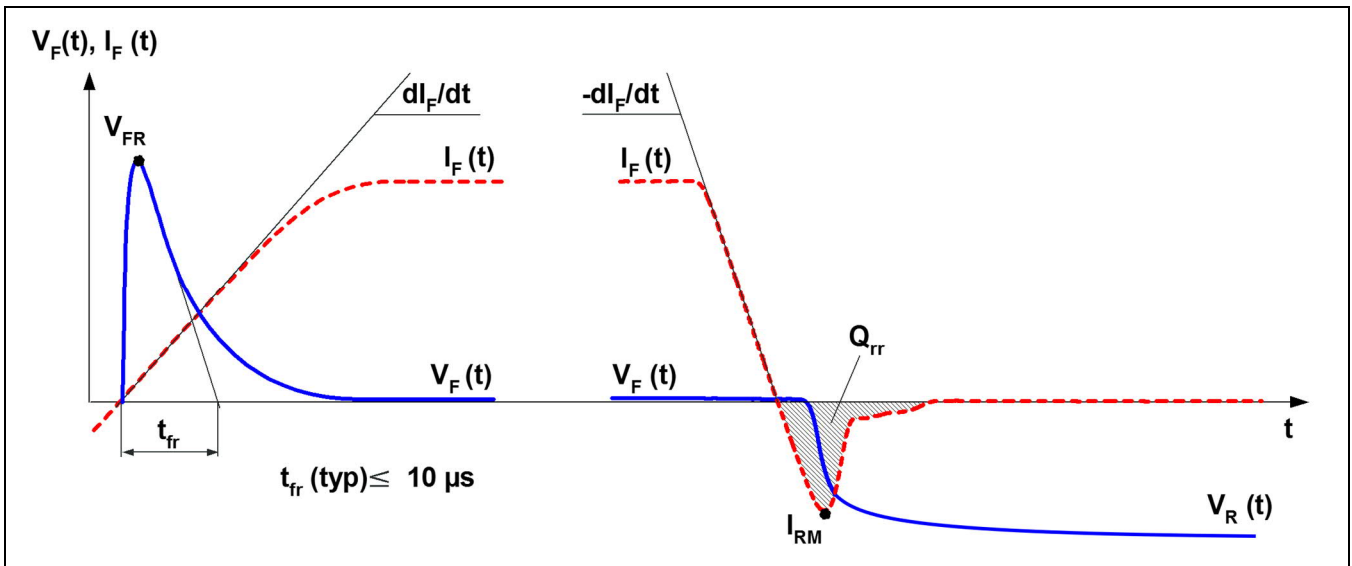
**Fig. 3** On-state voltage characteristics



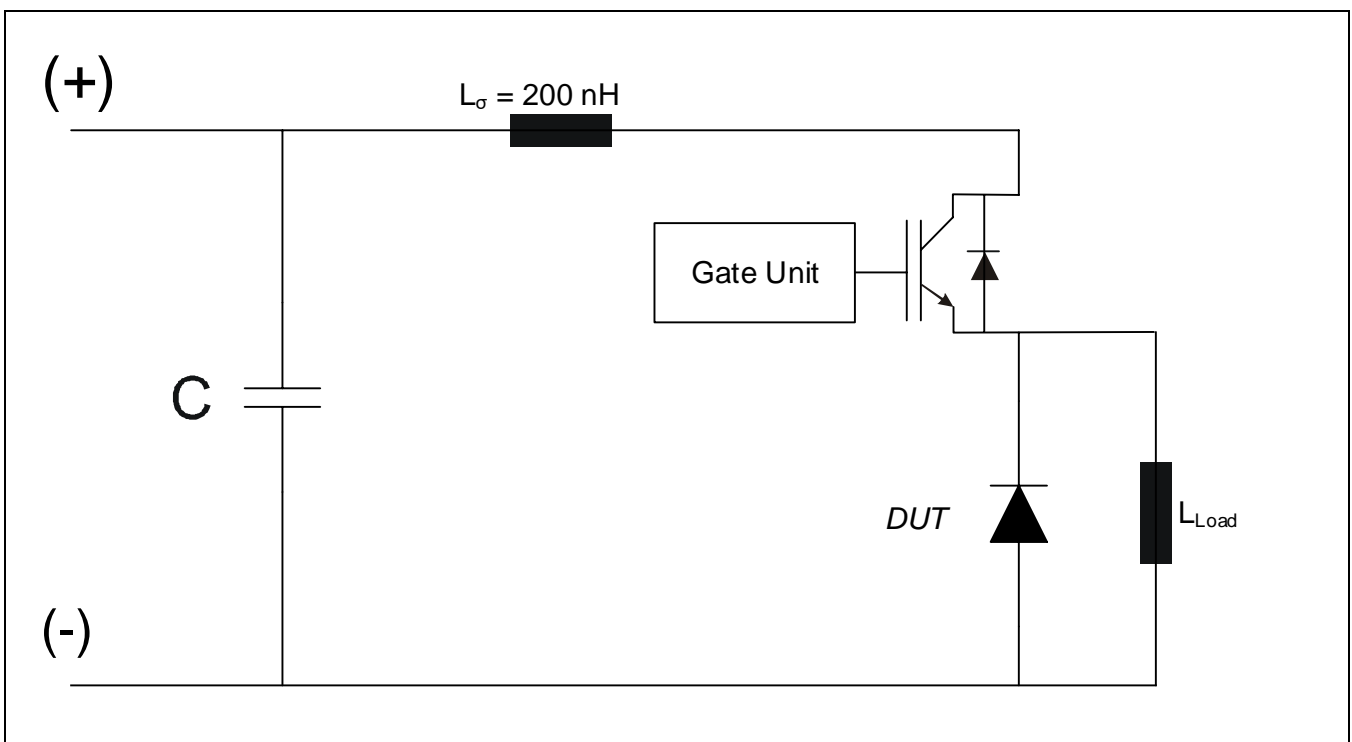
**Fig. 4** Peak forward recovery voltage



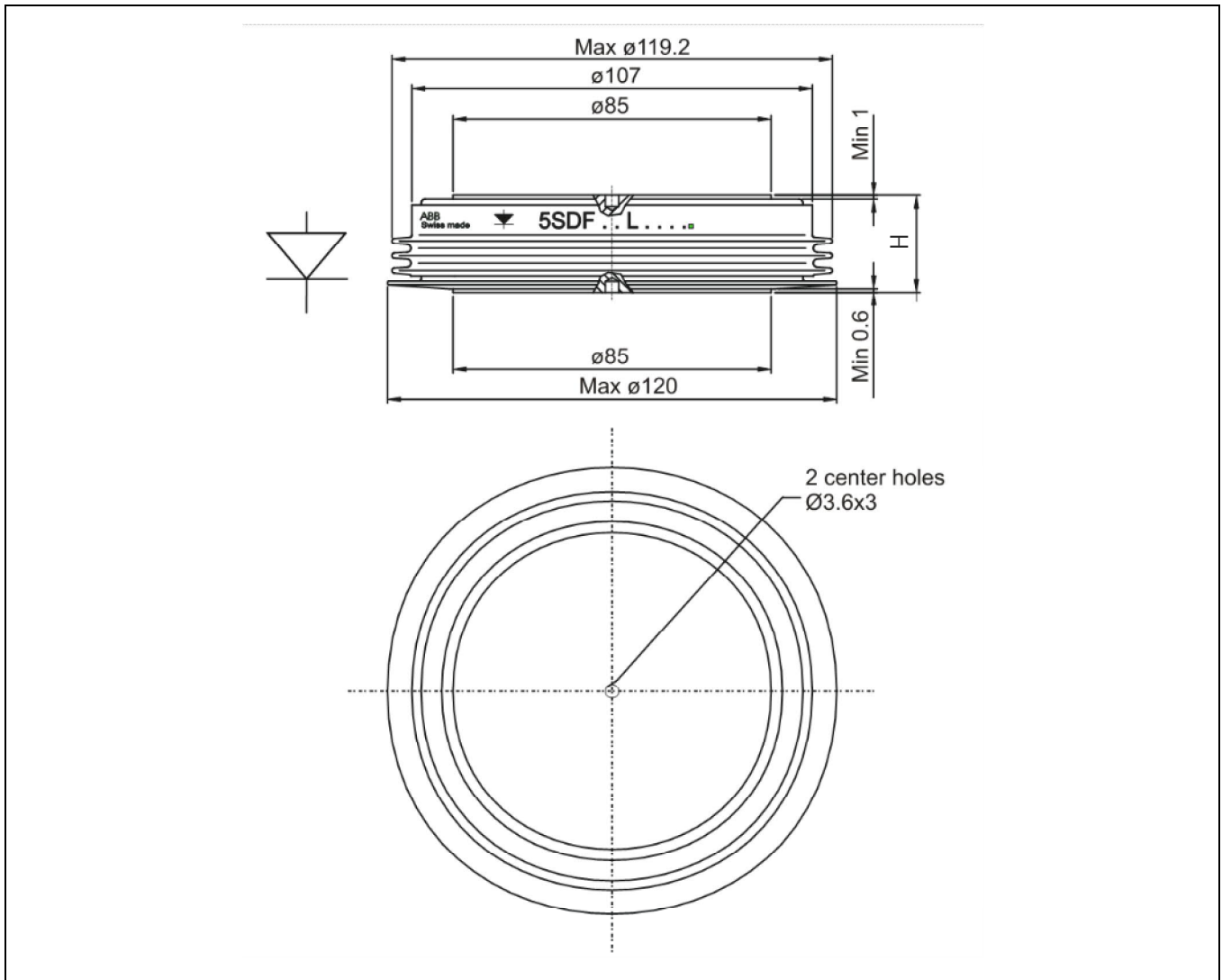
**Fig. 5** Reverse recovery characteristics (typical values)



**Fig. 6** General current and voltage waveforms



**Fig. 7** Reverse recovery test circuit. Fast Recovery Diode (DUT) in IGBT Application.



**Fig. 8** 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)

Please refer to <http://www.abb.com/semiconductors> for current version of documents.

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