

$V_{RRM}$	= 4500 V	<h2 style="margin: 0;">Fast Recovery Diode</h2> <h1 style="margin: 0;">5SDF 28L4521</h1>
$I_{F(AV)M}$	= 2620 A	
$I_{FSM}$	= $56 \cdot 10^3$ A	
$V_{F0} = r_F$	= 1.10 V	
	= 0.47 mΩ	
$V_{DC-Link}$	= 2800 V	

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

## Blocking

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

Parameter	Symbol	Conditions	5SDF 28L4521	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 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 <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	25.4		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 <sup>1)</sup>

Parameter	Symbol	Conditions	min	typ	max	Unit
Average on-state current	$I_{F(AV)M}$	Half sine wave, $T_c = 70\text{ °C}$			2620	A
RMS on-state current	$I_{F(RMS)}$				4120	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			$56 \cdot 10^3$	A
Limiting load integral	$I^2t$				$15.7 \cdot 10^6$	A <sup>2</sup> s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	$V_F$	$I_F = 3300\text{ A}$ , $T_{vj} = 140\text{ °C}$		2.35	2.6	V
Threshold voltage	$V_{F0}$	$I_F = 500 \dots 4000\text{ A}$ , $T_{vj} = 140\text{ °C}$			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	$V_{FRM}$	$di/dt = 3000\text{ A}/\mu\text{s}$ , $I_{FM} = 5500\text{ A}$ , $T_{vj} = 140\text{ °C}$		200		V

## Turn-off

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

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. decay rate of on-state current	$di/dt_{crit}$	$I_F = 3000\text{ A}$ , $V_{DC-Link} = 3000\text{ V}$ , $L_\sigma = 200\text{ nH}$			5300	A/ $\mu\text{s}$

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Reverse recovery charge	$Q_{rr}$	$I_F = 3300\text{ A}$ , $V_{DC-Link} = 2800\text{ V}$ , $di/dt = 5000\text{ A}/\mu\text{s}$ , $L_\sigma = 200\text{ nH}$ , IGBT = 5SNA 2000K450300, $T_{vj} = 140\text{ °C}$ , $V_{GE} = \pm 15\text{ V}$		10100	12000	$\mu\text{As}$
Reverse recovery current	$I_{RM}$			4100	5000	A
Turn-off energy	$E_{rr}$			21.5	24.90	J

## Thermal

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

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

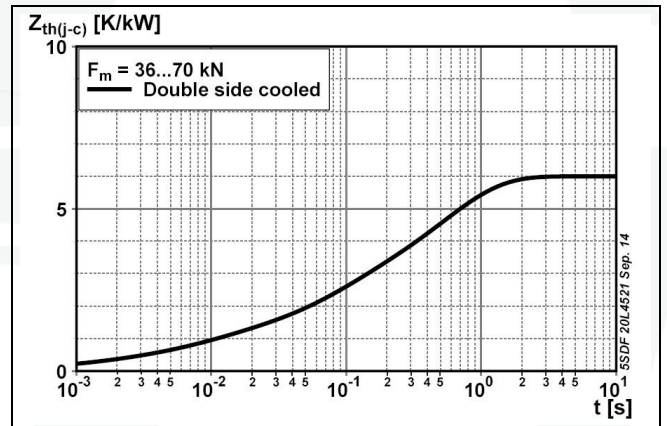
Parameter	Symbol	Conditions	min	typ	max	Unit
Thermal resistance junction to case	$R_{th(j-c)}$	Double-side cooled $F_m = 36... 70 \text{ kN}$			6	K/kW
	$R_{th(j-c)A}$	Anode-side cooled $F_m = 36... 70 \text{ kN}$			11.2	K/kW
	$R_{th(j-c)C}$	Cathode-side cooled $F_m = 36... 70 \text{ kN}$			12.9	K/kW
Thermal resistance case to heatsink	$R_{th(c-h)}$	Double-side cooled $F_m = 36... 70 \text{ kN}$			3	K/kW
	$R_{th(c-h)}$	Single-side cooled $F_m = 36... 70 \text{ kN}$			6	K/kW

**Characteristic values**

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
$\tau_i$ (s)	0.5336	0.0670	0.0074	0.0011



$Z_{th(j-c)}$

$\tau_i$

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

Max. on-state characteristic model:			
$V_{F25} = A_{Tvj} + B_{Tvj} I_F + C_{Tvj} \ln(I_F + 1) + D_{Tvj} \sqrt{I_F}$			
Valid for $I_F = 200 - 48000 \text{ A}$			
<b>A<sub>25</sub></b>	<b>B<sub>25</sub></b>	<b>C<sub>25</sub></b>	<b>D<sub>25</sub></b>

Max. on-state characteristic model:			
$V_{F140} = A_{Tvj} + B_{Tvj} I_F + C_{Tvj} \ln(I_F + 1) + D_{Tvj} \sqrt{I_F}$			
Valid for $I_F = 200 - 48000 \text{ A}$			
<b>A<sub>140</sub></b>	<b>B<sub>140</sub></b>	<b>C<sub>140</sub></b>	<b>D<sub>140</sub></b>

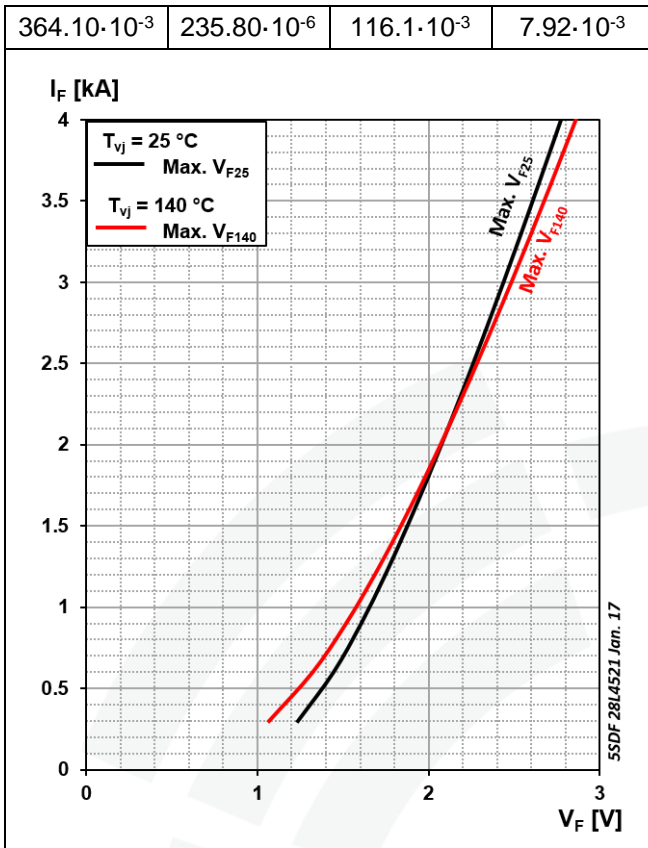


Fig. 2 On-state voltage characteristics

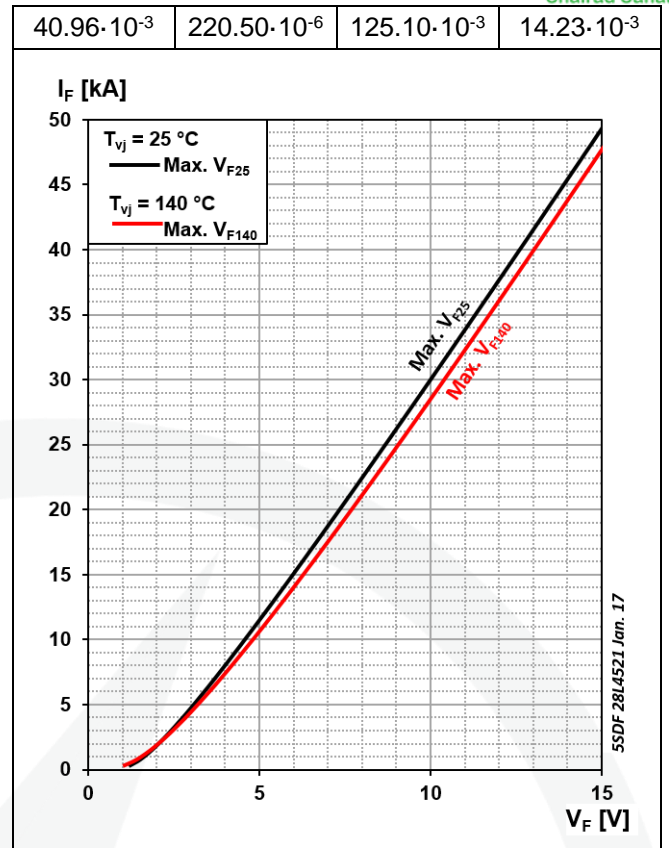


Fig. 3 On-state voltage characteristics

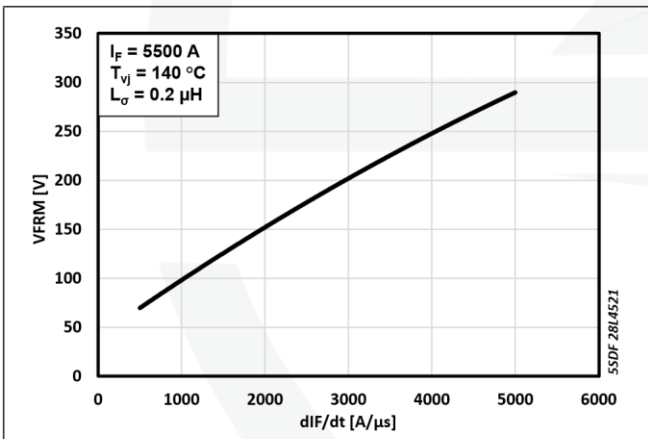


Fig. 4 Peak forward recovery voltage (typical values)

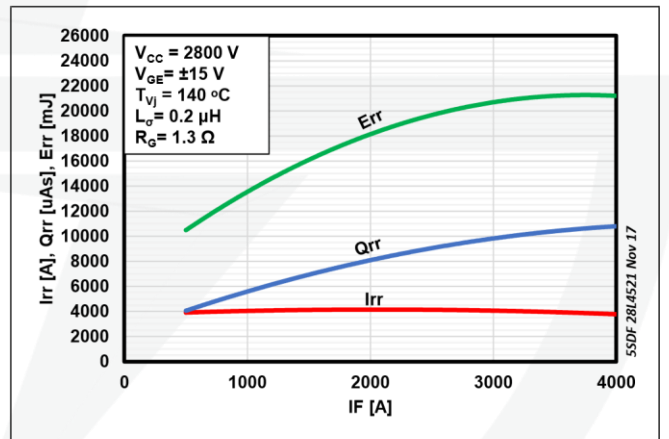


Fig. 5 Reverse recovery characteristics (typical values)

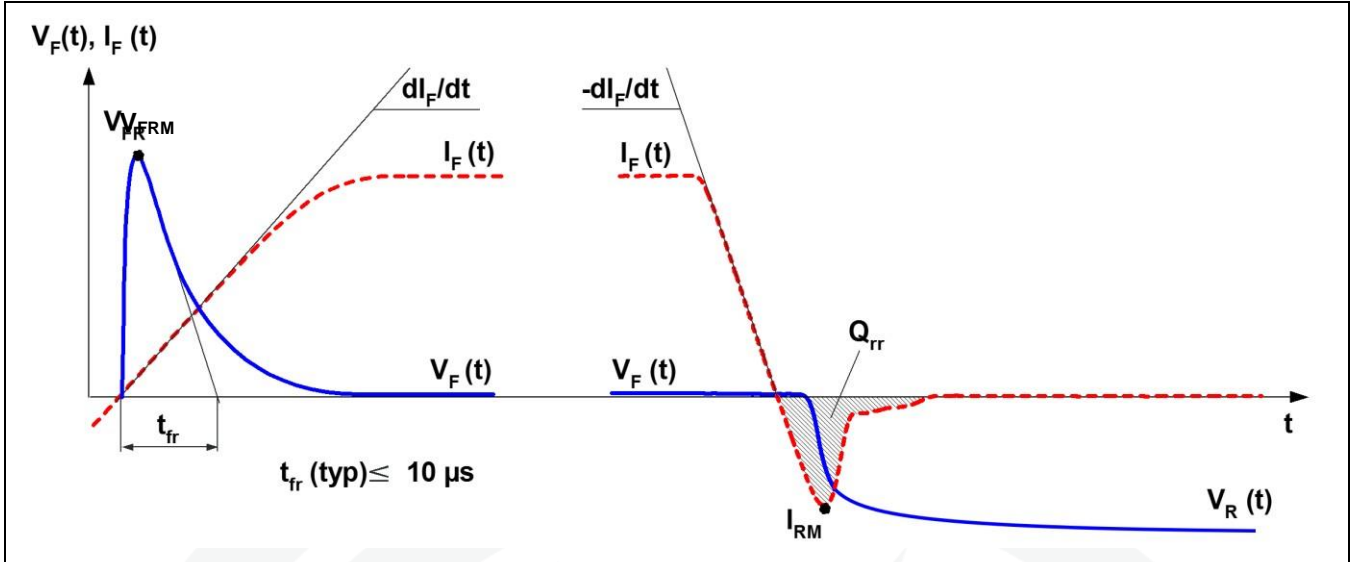


Fig. 6 General current and voltage waveforms

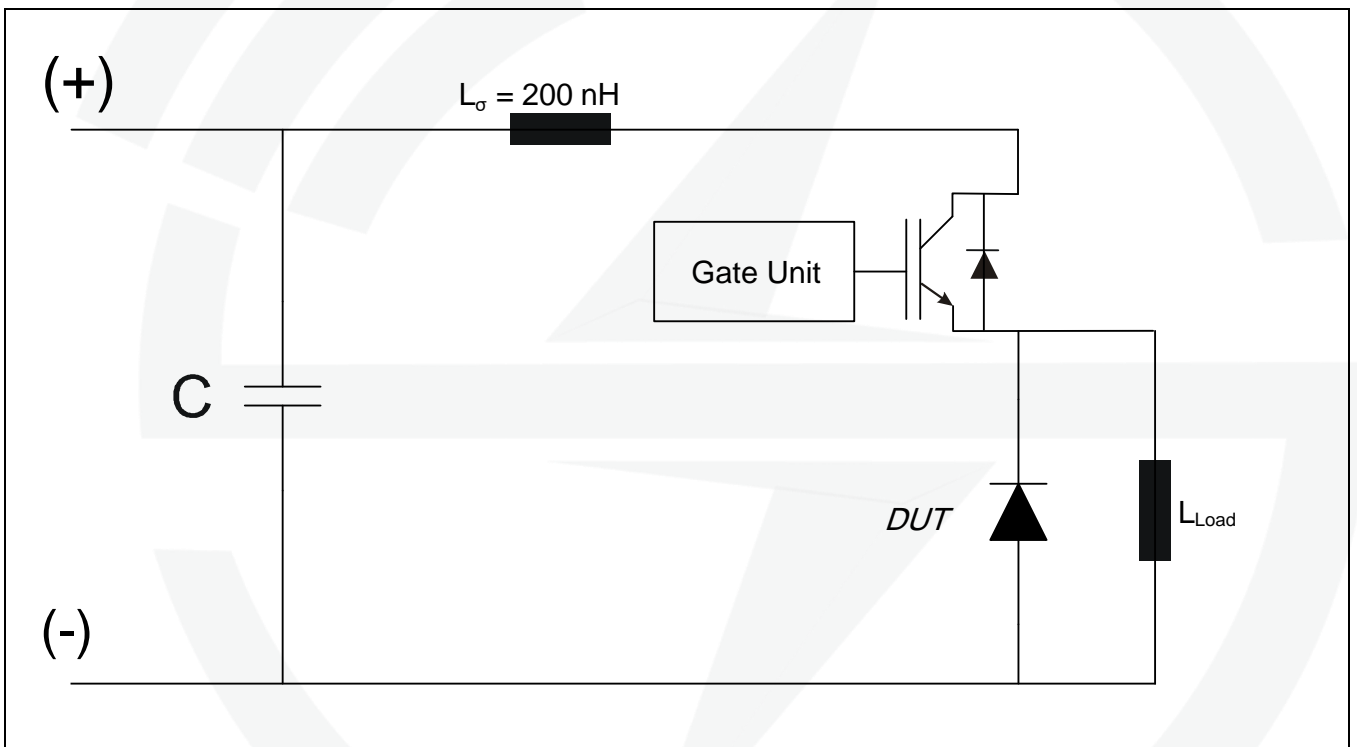
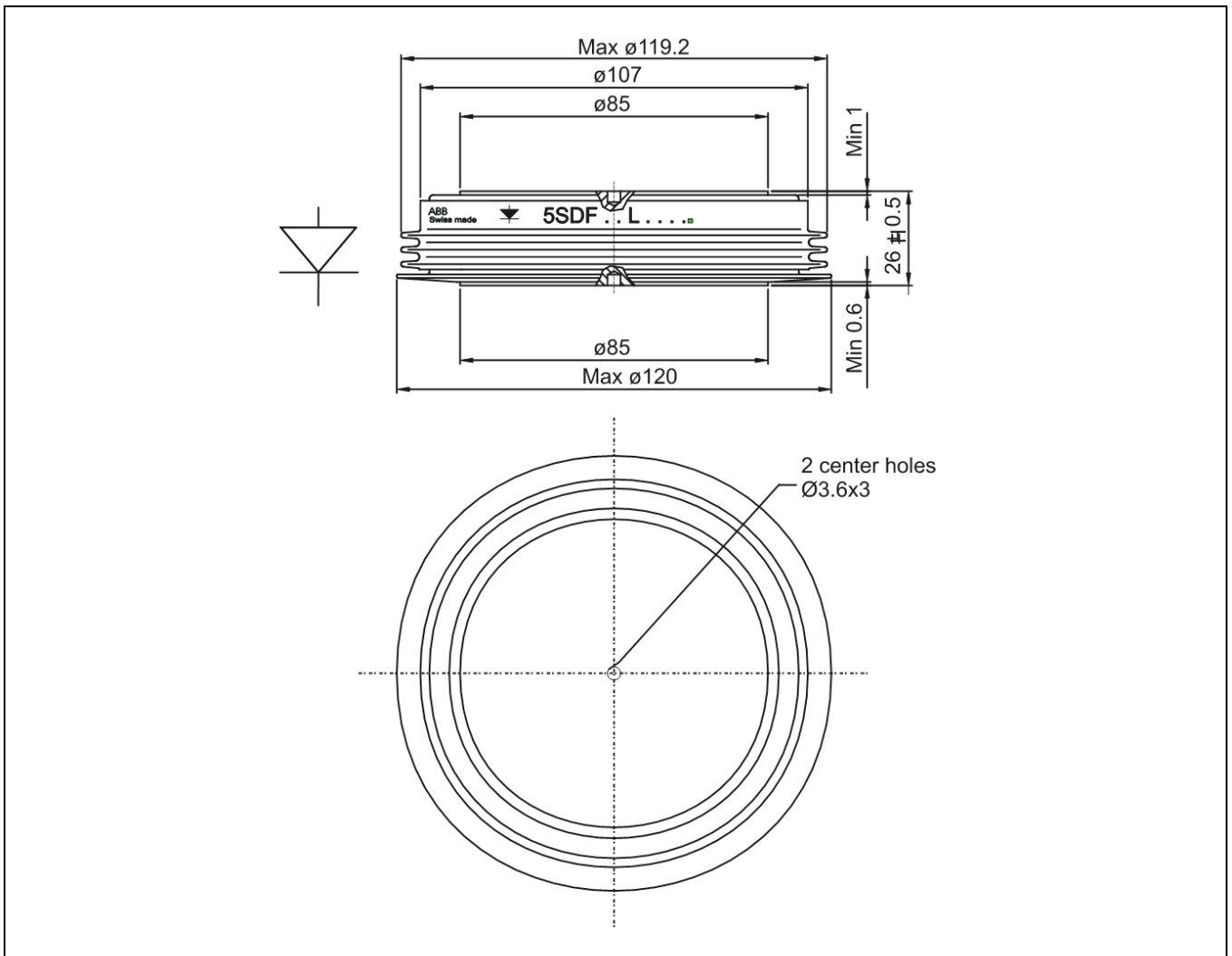


Fig. 7 Reverse recovery test circuit. Fast Recovery Diode (DUT) in IGBT Application.



**Fig. 8** Device Outline Drawing

**Related documents:**

Doc. Nr.	Title
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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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