

$V_{RRM}$	=	4500 V
$I_{F(AV)M}$	=	1440 A
$I_{FSM}$	=	$25 \times 10^3$ A
$V_{(T0)}$	=	1.75 V
$r_T$	=	0.88 mW
$V_{DClink}$	=	2800 V

# Fast Recovery Diode

## 5SDF 10H4520

Doc. No. 5SYA1170-00 March 05

- Low temperature bonding technology
- Industry standard housing
- Cosmic radiation withstand rating
- Low on-state and switching losses
- Optimized for snubberless operation

### 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, $T_{vj} = 140^\circ\text{C}$	4500	V
Permanent DC voltage for 100 FIT failure rate	$V_{DClink}$	Ambient cosmic radiation at sea level in open air. (100% Duty)	2800	V
Permanent DC voltage for 100 FIT failure rate	$V_{DClink}$	Ambient cosmic radiation at sea level in open air. (5% Duty)	3200	V

*Characteristic values*

Parameter	Symbol	Conditions	min	typ	max	Unit
Repetitive peak reverse current	$I_{RRM}$	$V_R = V_{RRM}$ , $T_{vj} = 140^\circ\text{C}$			100	mA

### Mechanical data

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

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	$F_m$		36	40	46	kN
Acceleration	$a$	Device unclamped			50	$\text{m/s}^2$
Acceleration	$a$	Device clamped			200	$\text{m/s}^2$

*Characteristic values*

Parameter	Symbol	Conditions	min	typ	max	Unit
Weight	$m$				0.83	kg
Housing thickness	$H$		25.8		26.1	mm
Surface creepage distance	$D_s$		33			mm
Air strike distance	$D_a$		20			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	$I_{F(AV)M}$	Half sine wave, $T_C = 70\text{ °C}$			1440	A
Max. RMS on-state current	$I_{F(RMS)}$				2260	A
Max. peak non-repetitive surge current	$I_{FSM}$	$t_p = 10\text{ ms}$ , $T_{vj} = 140\text{ °C}$ , $V_R = 0\text{ V}$			$25 \times 10^3$	A
Limiting load integral	$I^2t$				$3.12 \times 10^6$	A <sup>2</sup> s
Max. peak non-repetitive surge current	$I_{FSM}$	$t_p = 30\text{ ms}$ , $T_{vj} = 140\text{ °C}$ , $V_R = 0\text{ V}$			$16 \times 10^3$	A
Limiting load integral	$I^2t$				$3.84 \times 10^6$	A <sup>2</sup> s

### Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	$V_F$	$I_F = 2500\text{ A}$ , $T_{vj} = 140\text{ °C}$		3.1	3.8	V
Threshold voltage	$V_{(T0)}$	$T_{vj} = 140\text{ °C}$			1.75	V
Slope resistance	$r_T$	$I_F = 500 \dots 2500\text{ A}$			0.88	mΩ

## Turn-on

### Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Peak forward recovery voltage	$V_{FRM}$	$di_F/dt = 600\text{ A}/\mu\text{s}$ , $T_{vj} = 140\text{ °C}$			80	V
		$di_F/dt = 3000\text{ A}/\mu\text{s}$ , $T_{vj} = 140\text{ °C}$			250	V

## Turn-off

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

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. decay rate of on-state current	$di/dt_{crit}$	$I_{FM} = 4000\text{ A}$ , $T_{vj} = 140\text{ °C}$ $V_{DClink} = 2800\text{ V}$			600	A/ $\mu\text{s}$

### Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Reverse recovery current	$I_{RM}$	$I_{FM} = 3300\text{ A}$ , $V_{DC-Link} = 2800\text{ V}$			1600	A
Reverse recovery charge	$Q_{rr}$	$-di_F/dt = 600\text{ A}/\mu\text{s}$ , $L_{CL} = 300\text{ nH}$			5600	$\mu\text{C}$
Turn-off energy	$E_{rr}$	$C_{CL} = 10\text{ }\mu\text{F}$ , $R_{CL} = 0.65\text{ }\Omega$ , $T_{vj} = 140\text{ °C}$ , $D_{CL} = 5\text{SDF } 10\text{H}4520$			9.5	J

## Thermal

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

Parameter	Symbol	Conditions	min	typ	max	Unit
Operating junction temperature range	$T_{vj}$		0		140	°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 $F_m = 36...46$ kN			10	K/kW
	$R_{th(j-c)A}$	Anode-side cooled $F_m = 36...46$ kN			18	K/kW
	$R_{th(j-c)C}$	Cathode-side cooled $F_m = 36...46$ kN			22	K/kW
Thermal resistance case to heatsink	$R_{th(c-h)}$	Double-side cooled $F_m = 36...46$ kN			3	K/kW
	$R_{th(c-h)}$	Single-side cooled $F_m = 36...46$ kN			6	K/kW

Analytical function for transient thermal impedance:

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

i	1	2	3	4
$R_{th i}$ (K/kW)	6.599	2.148	1.011	0.249
$\tau_i$ (s)	0.5067	0.0458	0.0054	0.0007

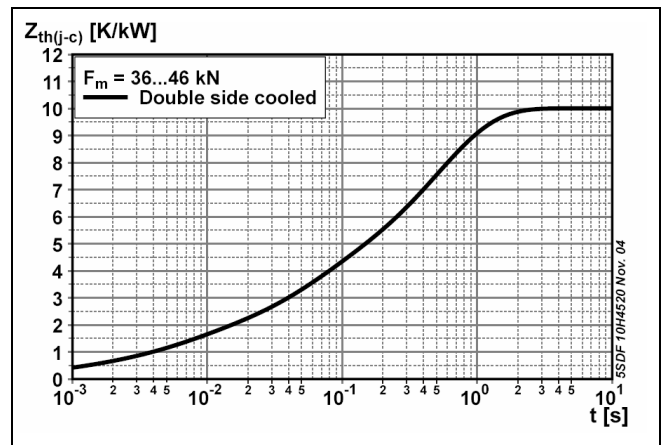


Fig. 1 Transient thermal impedance junction-to-case.

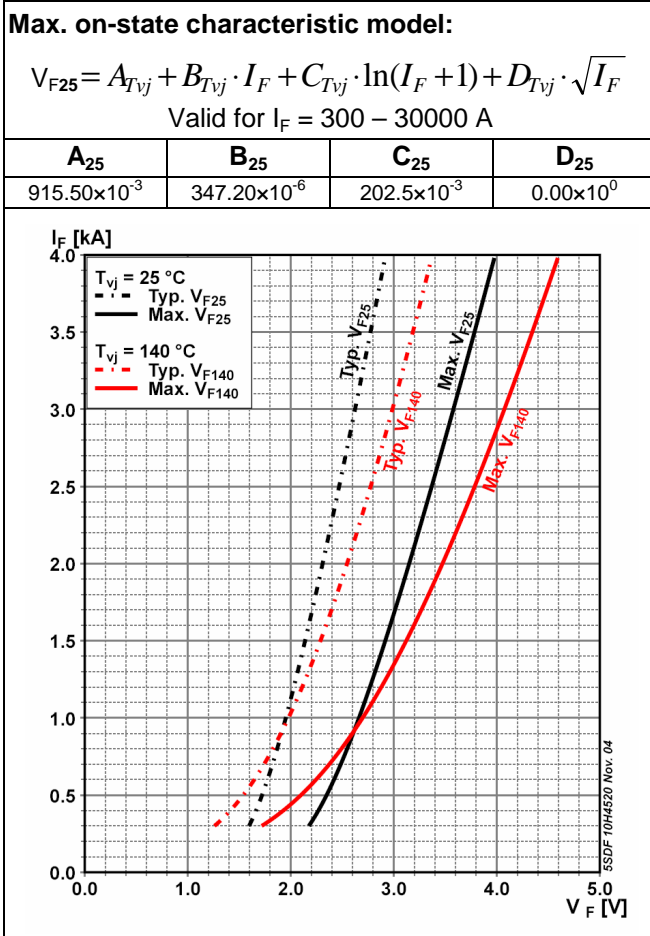


Fig. 2 Max. on-state voltage characteristics

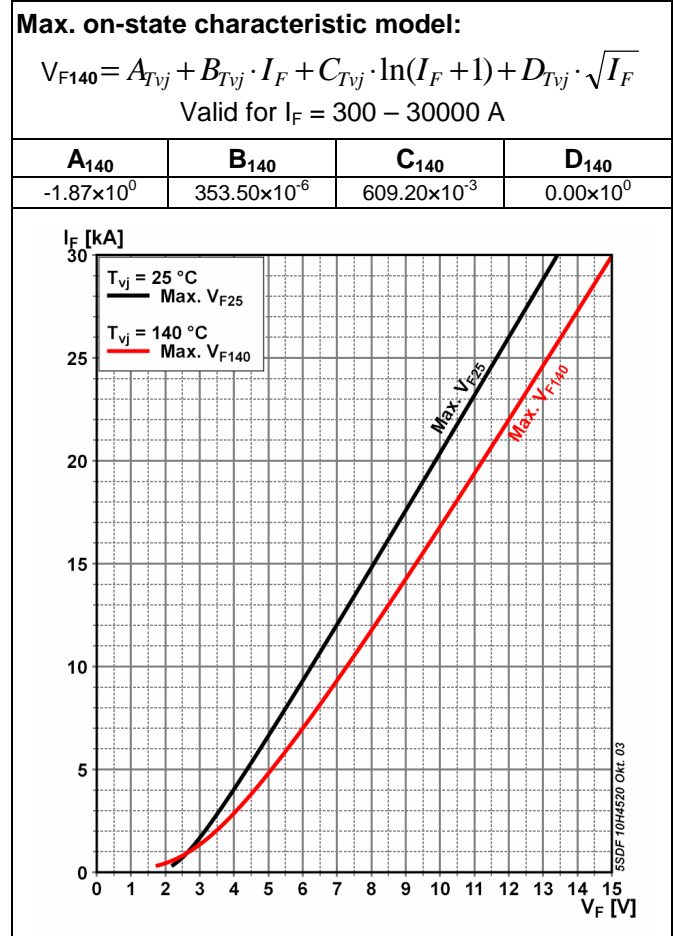


Fig. 3 Max. on-state voltage characteristics

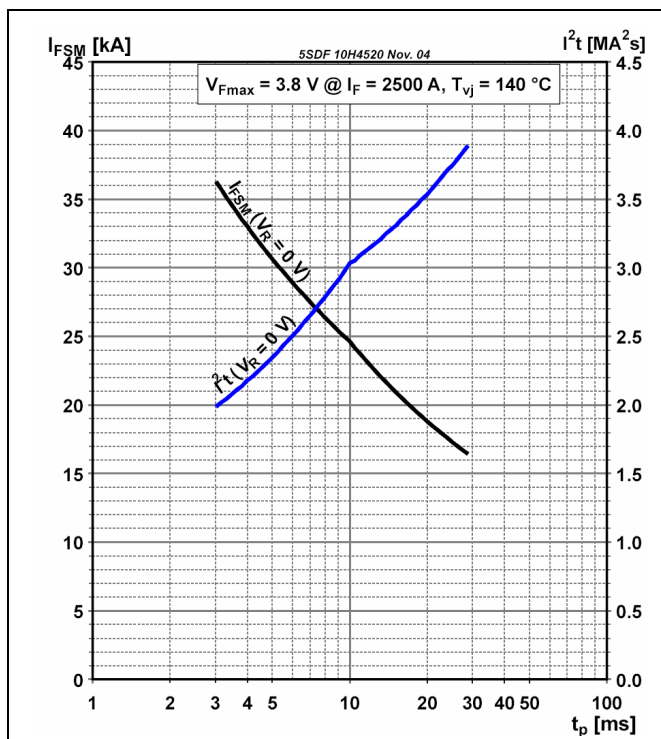


Fig. 4 Surge on-state current vs. pulse length. Half-sine wave.

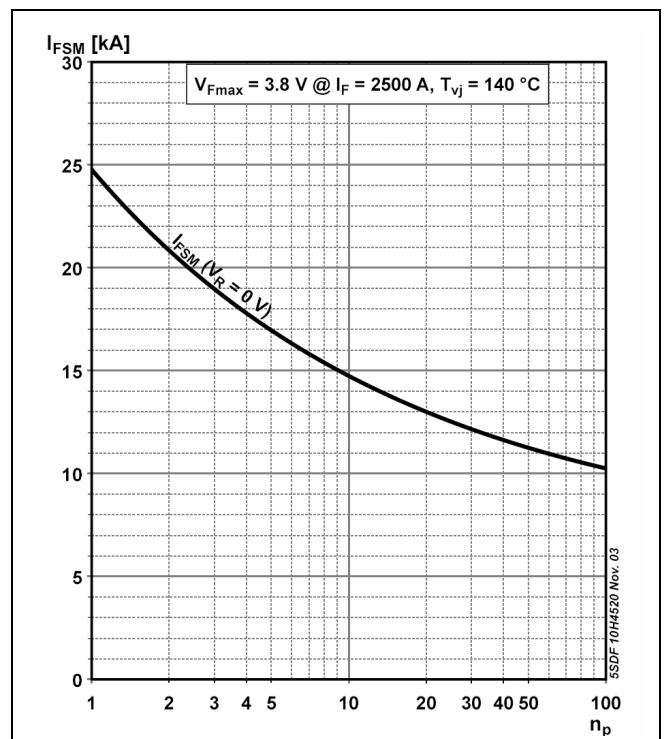


Fig. 5 Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz

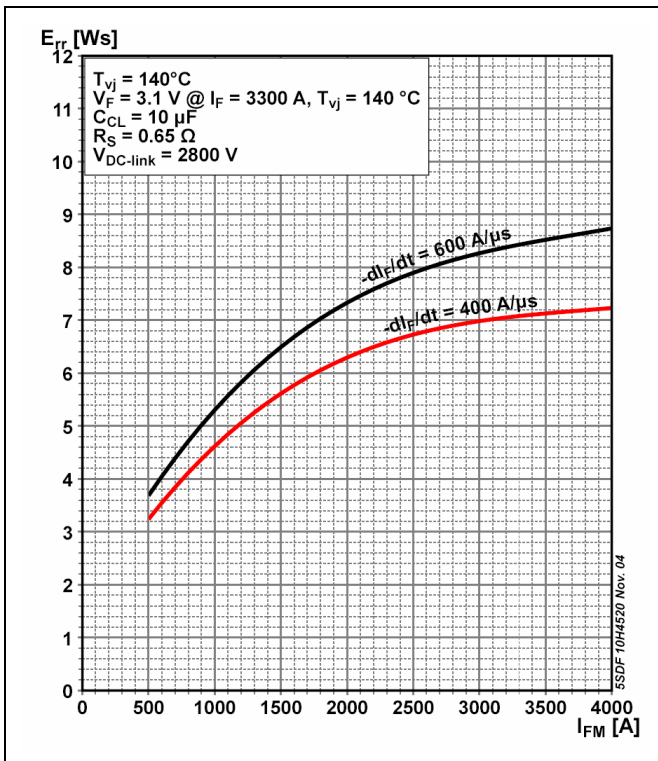


Fig. 6 Upper scatter range of turn-off energy per pulse vs. turn-off current.

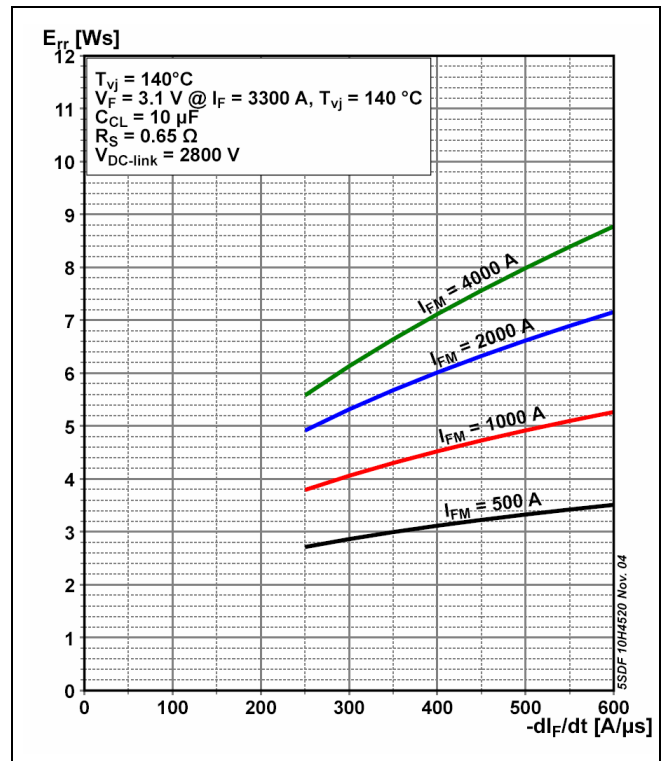


Fig. 7 Upper scatter range of turn-off energy per pulse vs reverse current rise rate.

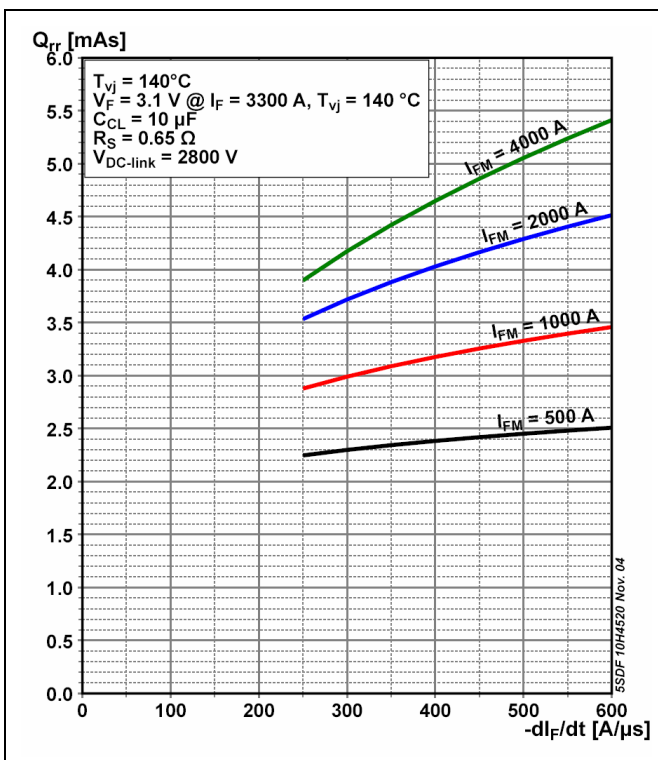


Fig. 8 Upper scatter range of repetitive reverse recovery charge vs reverse current rise rate.

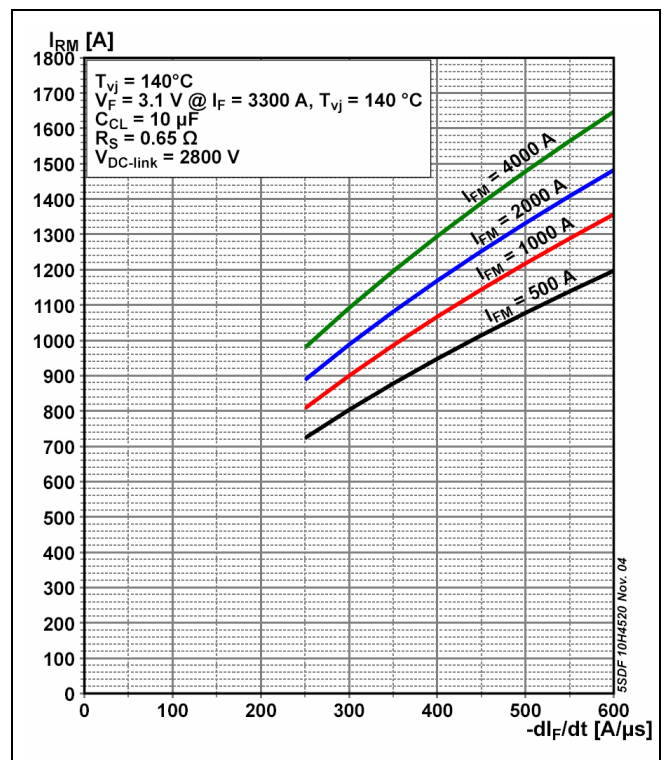


Fig. 9 Upper scatter range of reverse recovery current vs reverse current rise rate.

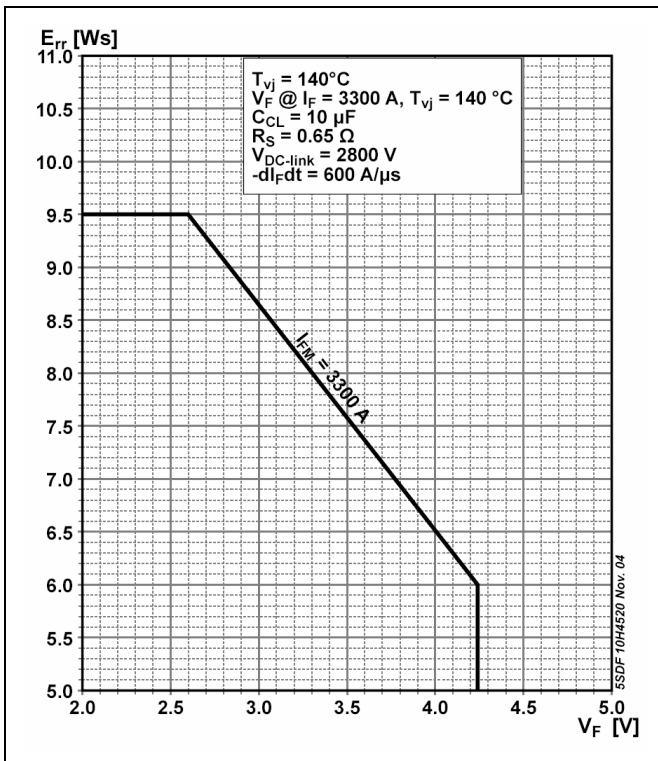


Fig. 10 Max. turn-off energy per pulse vs. on-state voltage.

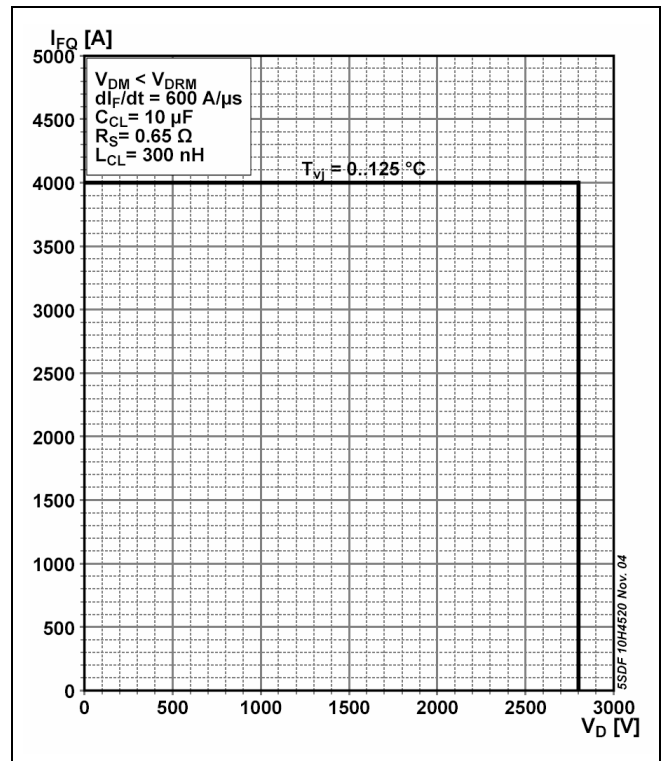


Fig. 11 Diode Safe Operating Area

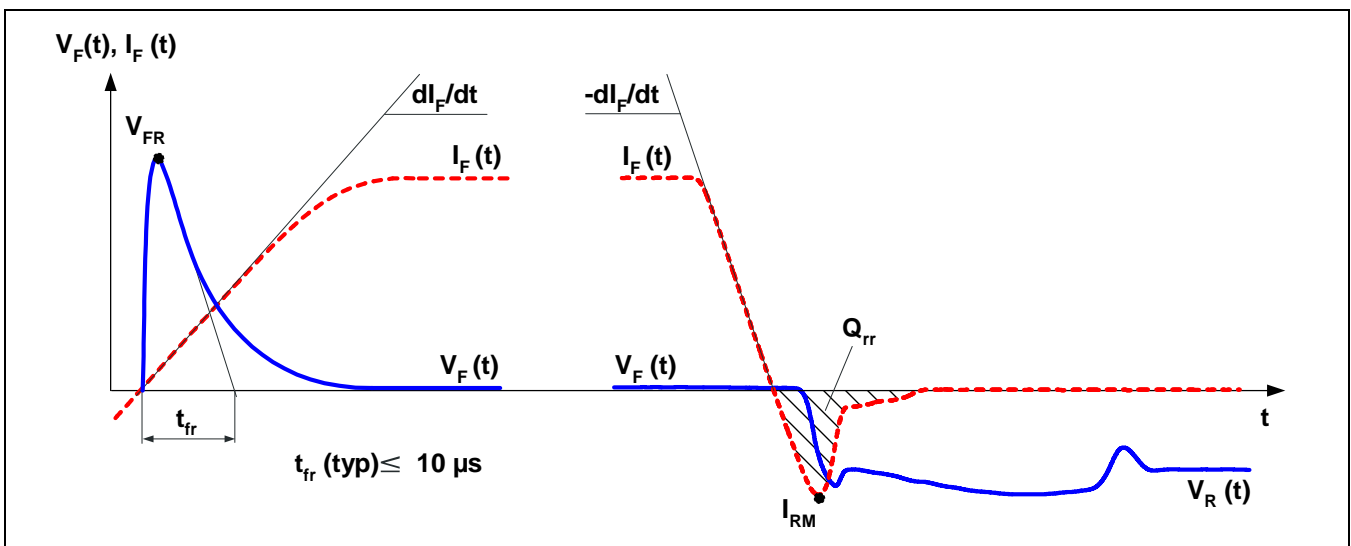


Fig. 12 General current and voltage waveforms.

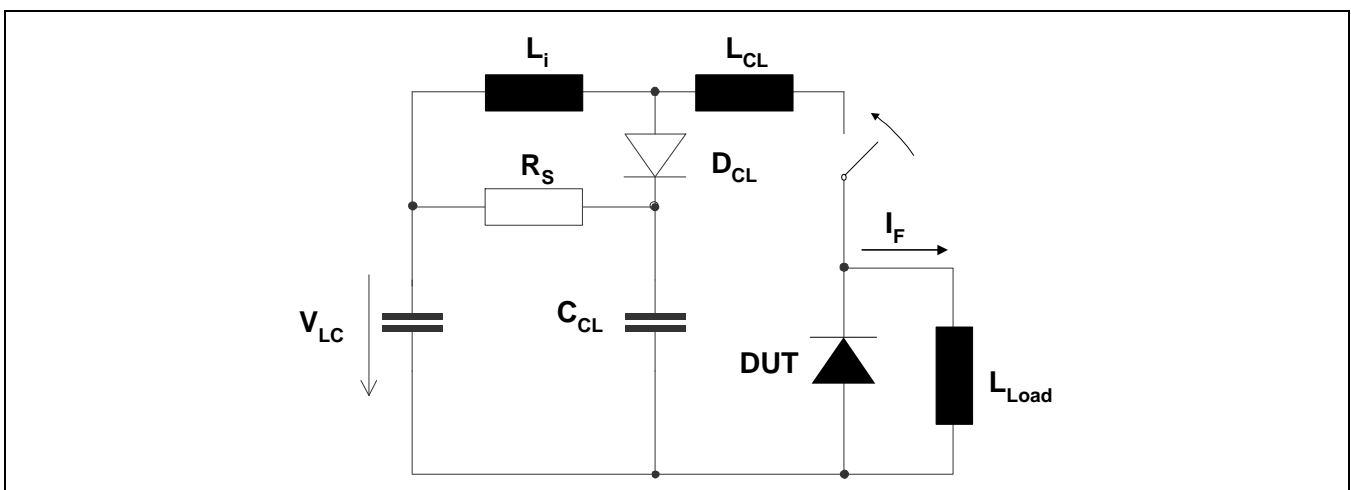
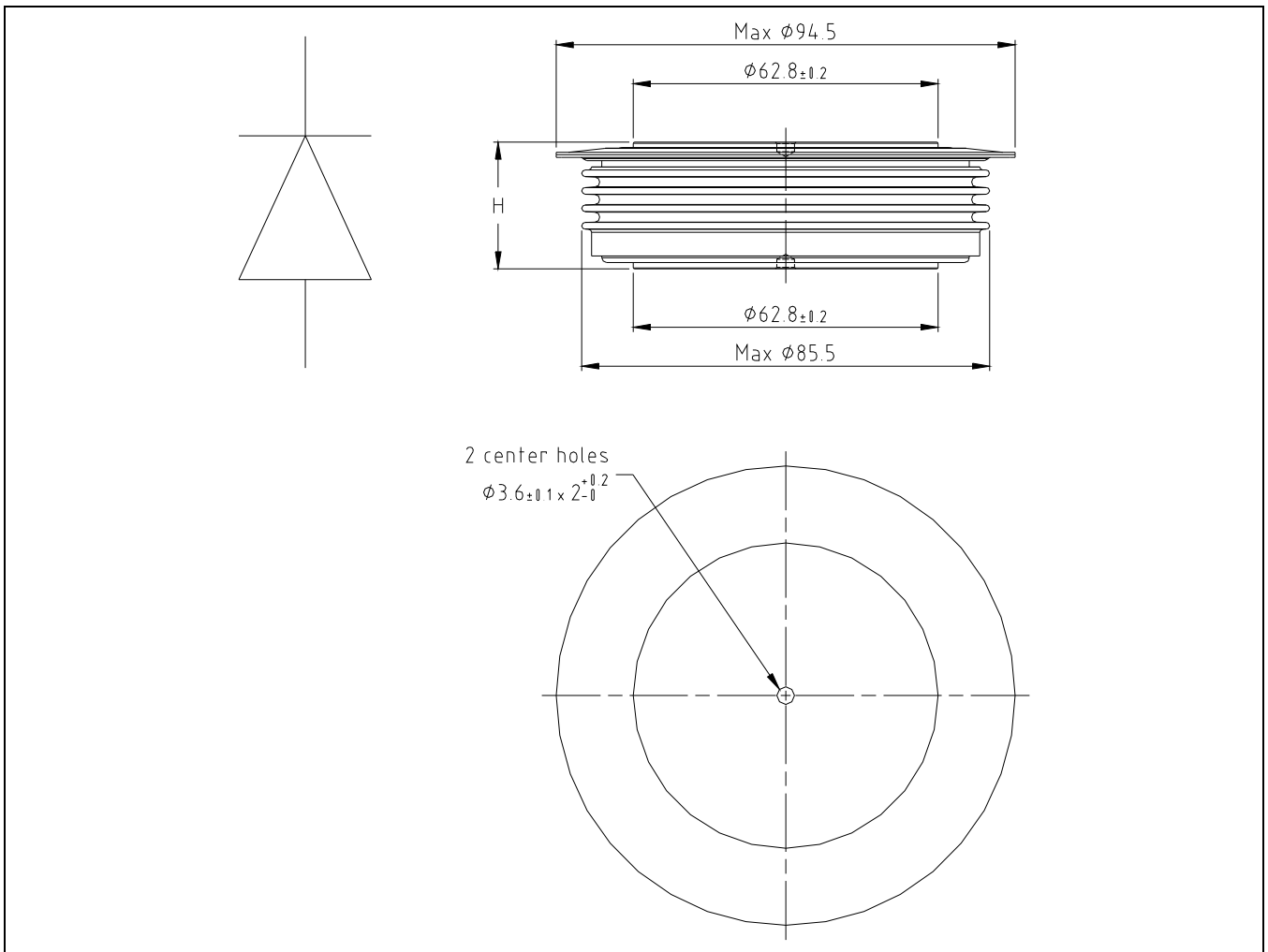


Fig. 13 Test circuit.



**Fig. 14** Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise.

### Related application notes:

Doc. Nr	Titel
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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