

|               |   |                   |
|---------------|---|-------------------|
| $V_{RRM}$     | = | 5500 V            |
| $I_{F(AV)M}$  | = | 175 A             |
| $I_{FSM}$     | = | $3 \times 10^3$ A |
| $V_{(T0)}$    | = | 3.35 V            |
| $r_T$         | = | 7.2 mW            |
| $V_{DC-link}$ | = | 3300 V            |

# Fast Recovery Diode

## 5SDF 02D6004

### PRELIMINARY

Doc. No. 5SYA1118-02 Okt. 02

- Patented free-floating 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, $T_{vj} = 115^\circ\text{C}$       | 5500  | V    |
| Permanent DC voltage for 100 FIT failure rate | $V_{DC-link}$ | Ambient cosmic radiation at sea level in open air. (100% Duty) | 3300  | V    |
| Permanent DC voltage for 100 FIT failure rate | $V_{DC-link}$ | Ambient cosmic radiation at sea level in open air. (5% Duty)   | 3900  | V    |

### Characteristic values

| Parameter                       | Symbol    | Conditions                                     | min | typ | max | Unit |
|---------------------------------|-----------|--|-----|-----|-----|------|
| Repetitive peak reverse current | $I_{RRM}$ | $V_R = V_{RRM}$ , $T_{vj} = 115^\circ\text{C}$ |     |     | 20  | mA   |

## Mechanical data

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

| Parameter      | Symbol | Conditions       | min | typ | max | Unit           |
|----------------|--------|------------------|-----|-----|-----|----------------|
| Mounting force | $F_m$  |                  | 14  | 16  | 18  | 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                    | $m$    |            |      |     | 0.25 | kg   |
| Housing thickness         | $H$    |            | 26.0 |     | 26.6 | mm   |
| Surface creepage distance | $D_s$  |            | 30   |     |      | mm   |
| Air strike distance       | $D_a$  |            | 20   |     |      | mm   |

Note 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, $T_C = 70\text{ °C}$                                 |     |     | 175              | A                |
| Max. RMS on-state current              | $I_{F(RMS)}$ |  |     |     | 275              | A                |
| Max. peak non-repetitive surge current | $I_{FSM}$    | $t_p = 10\text{ ms}$ , $T_{vj} = 115\text{ °C}$ , $V_R = 0\text{ V}$ |     |     | $3 \times 10^3$  | A                |
| Limiting load integral                 | $I^2t$       |  |     |     | $45 \times 10^3$ | A <sup>2</sup> s |
| Max. peak non-repetitive surge current | $I_{FSM}$    | $t_p = 1\text{ ms}$ , $T_{vj} = 115\text{ °C}$ , $V_R = 0\text{ V}$  |     |     | $8 \times 10^3$  | A                |
| Limiting load integral                 | $I^2t$       |  |     |     | $32 \times 10^3$ | A <sup>2</sup> s |

### Characteristic values

| Parameter         | Symbol     | Conditions                                      | min | typ | max  | Unit |
|-------------------|------------|---|-----|-----|------|------|
| On-state voltage  | $V_F$      | $I_F = 520\text{ A}$ , $T_{vj} = 115\text{ °C}$ |     |     | 7.1  | V    |
| Threshold voltage | $V_{(T0)}$ | $T_{vj} = 115\text{ °C}$                        |     |     | 3.35 | V    |
| Slope resistance  | $r_T$      | $I_F = 200 \dots 1000\text{ A}$                 |     |     | 7.2  | mΩ   |

## Turn-on

### Characteristic values

| Parameter                     | Symbol    | Conditions   | min | typ | max | Unit |
|-------------------------------|-----------|--|-----|-----|-----|------|
| Peak forward recovery voltage | $V_{FRM}$ | $di/dt = 1000\text{ A}/\mu\text{s}$ , $T_{vj} = 115\text{ °C}$ |     |     | 370 | V    |

## Turn-off

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

| Parameter                           | Symbol         | Conditions   | min | typ | max | Unit |
|-------------------------------------|----------------|--|-----|-----|-----|------|
| Max. decay rate of on-state current | $di/dt_{crit}$ | $I_{FM} = A$ , $T_{vj} = 115\text{ °C}$<br>$V_{DC-link} = 3300\text{ V}$ |     |     | 220 | A/μs |

### Characteristic values

| Parameter                | Symbol   | Conditions   | min | typ | max | Unit |
|--------------------------|----------|--|-----|-----|-----|------|
| Reverse recovery current | $I_{RM}$ | $I_{FQ} = 520\text{ A}$ , $V_{DC-Link} = 3300\text{ V}$            |     |     | 300 | A    |
| Reverse recovery charge  | $Q_{rr}$ | $di/dt = 220\text{ A}/\mu\text{s}$ , $L_{CL} = \text{nH}$          |     |     |     | μC   |
| Turn-off energy          | $E_{rr}$ | $C_{CL} = \mu\text{F}$ , $R_{CL} = \Omega$ , $T_j = 115\text{ °C}$ |     |     | 1.8 | J    |

## Thermal

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

| Parameter                            | Symbol    | Conditions | min | typ | max | Unit |
|--------------------------------------|-----------|------------|-----|-----|-----|------|
| Operating junction temperature range | $T_{vj}$  |            | -40 |     | 115 | °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<br>$F_m = 14...18$ kN  |     |     | 40  | K/kW |
|                                     | $R_{th(j-c)A}$ | Anode-side cooled<br>$F_m = 14...18$ kN   |     |     | 80  | K/kW |
|                                     | $R_{th(j-c)C}$ | Cathode-side cooled<br>$F_m = 14...18$ kN |     |     | 80  | K/kW |
| Thermal resistance case to heatsink | $R_{th(c-h)}$  | Double-side cooled<br>$F_m = 14...18$ kN  |     |     | 8   | K/kW |
|                                     | $R_{th(c-h)}$  | Single-side cooled<br>$F_m = 14...18$ kN  |     |     | 16  | 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) | 25.699 | 9.472  | 3.381  | 1.466  |
| $\tau_i$ (s)      | 0.3802 | 0.0483 | 0.0060 | 0.0018 |

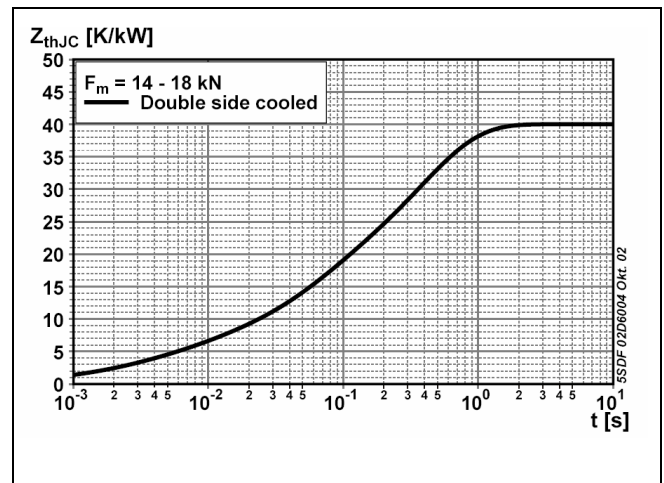


Fig. 1 Transient thermal impedance (junction to case) vs. time in analytical and graphical form (max. values)

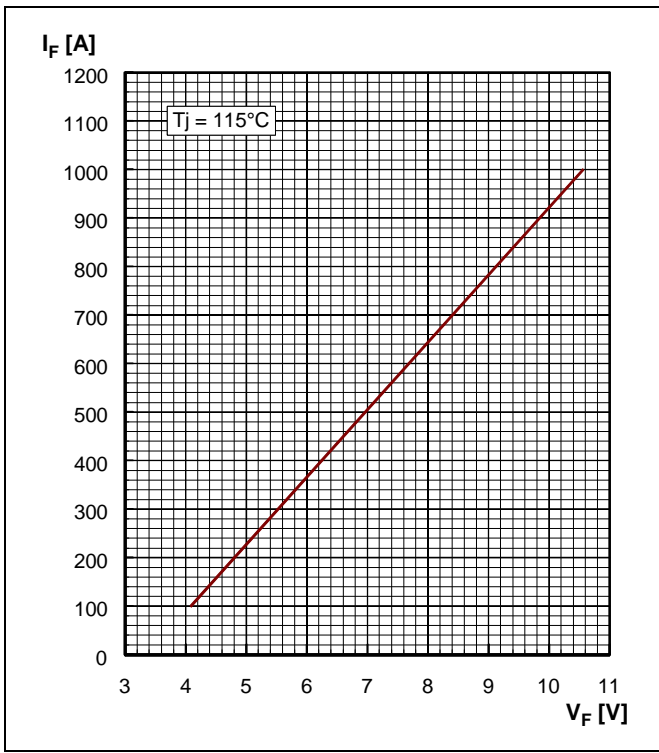


Fig. 2 Forward current vs. forward voltage

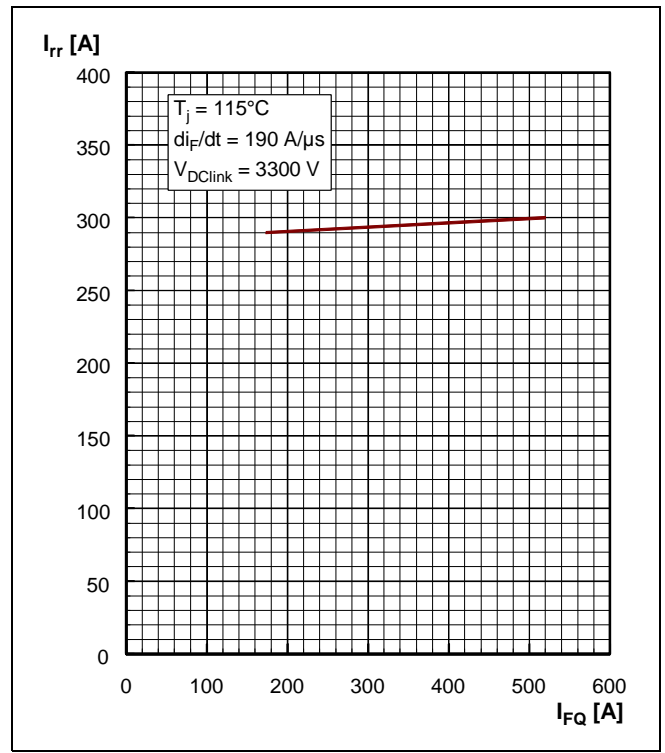


Fig. 3 Diode reverse recovery current vs. turn-off current

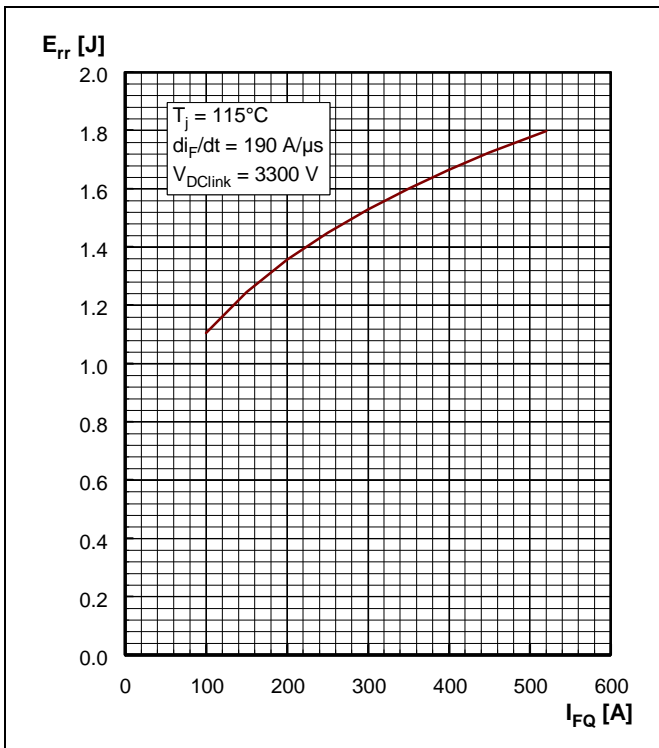


Fig. 4 Diode turn-off energy per pulse vs. turn-off current

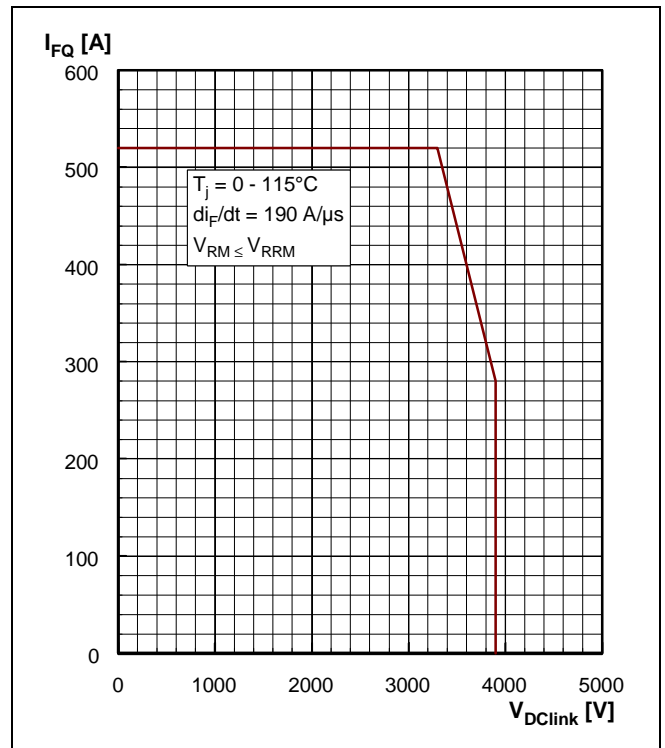


Fig. 5 Max. repetitive diode forward current

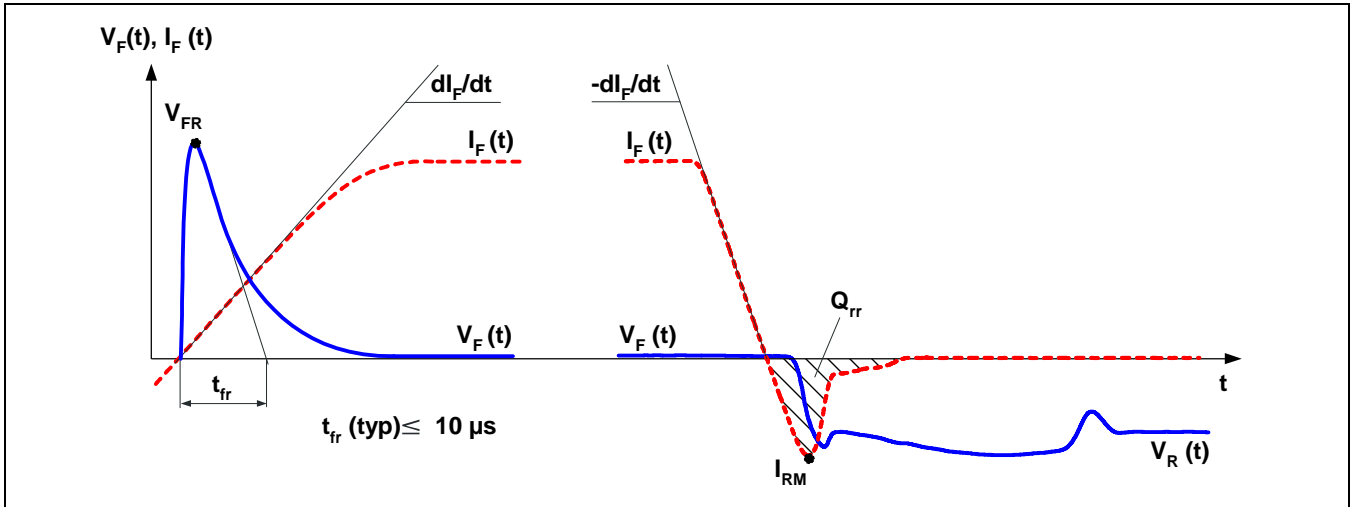


Fig. 6 General current and voltage waveforms

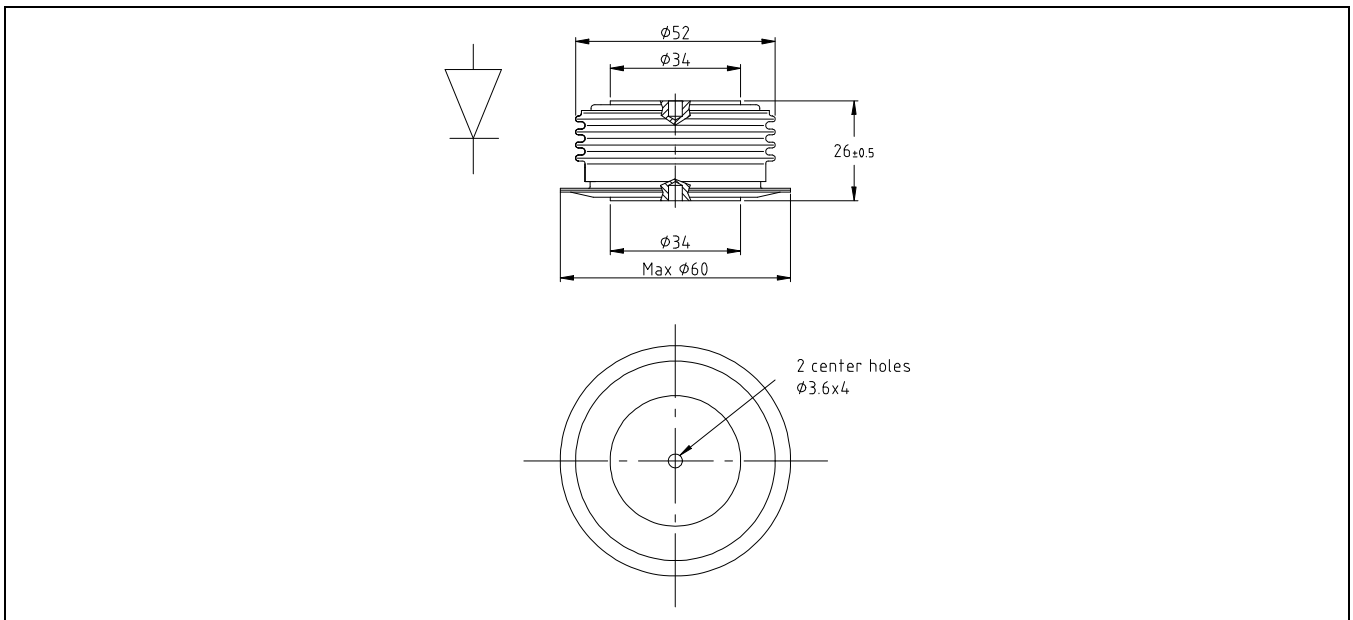


Fig. 7 Outline drawing; all dimensions are in millimeters and represent nominal values unless stated otherwise

### Related documents:

| Doc. Nr   | Titel   |
|-----------|---|
| 5SYA 2036 | Recommendations regarding mechanical clamping of Press Pack High Power Semiconductors   |
| 5SZK 9104 | Specification of environmental class for pressure contact diodes, PCTs and GTO, STORAGE available on request, please contact factory        |
| 5SZK 9105 | Specification of environmental class for pressure contact diodes, PCTs and GTO, TRANSPORTATION available on request, please contact factory |

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

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