

## Key Parameters

|            |   |         |
|------------|---|---------|
| $V_{RRM}$  | = | 2300 V  |
| $I_{FAVM}$ | = | 2350 A  |
| $I_{FSM}$  | = | 29.0 kA |
| $V_{F0}$   | = | 0.84 V  |
| $r_F$      | = | 0.13 mΩ |

# Avalanche Rectifier Diode

## 5SDA 24F2303

Doc. No. 5SYA 1131 - 01 Apr-98

## Features

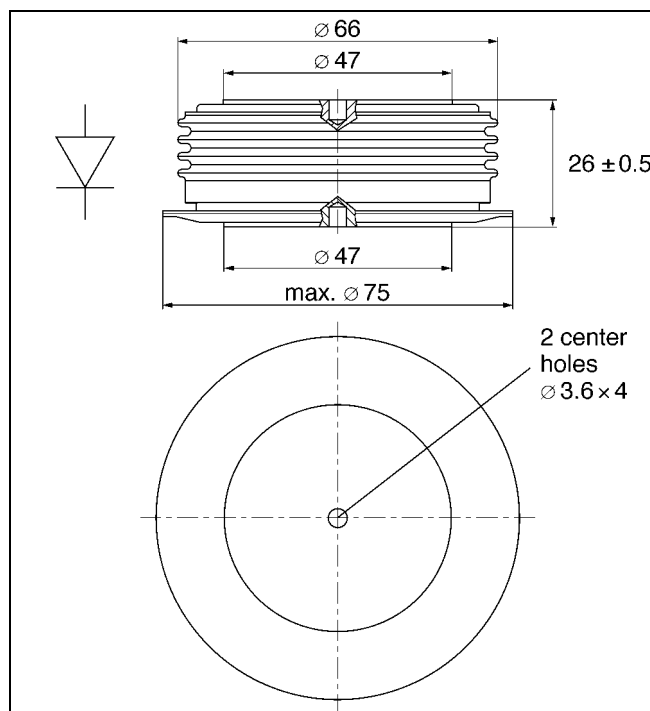
- Optimized for line frequency rectifiers
- Low on-state voltage, narrow  $V_F$ -bands for parallel operation
- Self protected against transient overvoltages
- Guaranteed maximum avalanche power dissipation
- Industry standard housing

## Blocking

| Part number | 5SDA 24F2303          | 5SDA 24F2003 | 5SDA 24F1703 | Condition                                        |
|-------------|-----------------------|--------------|--------------|--------------------------------------------------|
| $V_{RRM}$   | 2300                  | 2000         | 1700         | $f = 50 \text{ Hz}$ $t_p = 10 \text{ ms}$        |
| $V_{RSM}$   | 2530                  | 2200         | 1870         | $t_p = 10 \text{ ms}$ $T_j = 160^\circ\text{C}$  |
| $I_{RRM}$   | $\leq 50 \text{ mA}$  |              |              | $V_{RRM}$ $T_j = 160^\circ\text{C}$              |
| $P_{RSM}$   | $\leq 100 \text{ kW}$ |              |              | $t_p = 20 \mu\text{s}$ $T_j = 45^\circ\text{C}$  |
|             | $\leq 75 \text{ kW}$  |              |              | $t_p = 20 \mu\text{s}$ $T_j = 160^\circ\text{C}$ |

## Mechanical data

|       |                           |      |                      |
|-------|---------------------------|------|----------------------|
| $F_M$ | Mounting force            | min. | 20 kN                |
|       |                           | max. | 24 kN                |
| a     | Acceleration              |      |                      |
|       | Device unclamped          |      | 50 m/s <sup>2</sup>  |
|       | Device clamped            |      | 200 m/s <sup>2</sup> |
| m     | Weight                    |      | 0.5 kg               |
| $D_s$ | Surface creepage distance |      | 30 mm                |
| $D_a$ | Air strike distance       |      | 20 mm                |



## On-state

|                    |                                        |                                       |                                       |   |        |                                      |
|--------------------|----------------------------------------|---------------------------------------|---------------------------------------|---|--------|--------------------------------------|
| I <sub>FAVM</sub>  | Max. average on-state current          | 2350 A                                | Half sine wave, T <sub>C</sub> = 85°C |   |        |                                      |
| I <sub>FRMS</sub>  | Max. RMS on-state current              | 3640 A                                |                                       |   |        |                                      |
| I <sub>FSM</sub>   | Max. peak non-repetitive surge current | 29.0 kA                               | tp                                    | = | 10 ms  | T <sub>j</sub> = 160°C               |
|                    |                                        | 30.5 kA                               | tp                                    | = | 8.3 ms | After surge:                         |
| I <sup>2</sup> t   | Limiting load integral                 | 4205·10 <sup>3</sup> A <sup>2</sup> s | tp                                    | = | 10 ms  | V <sub>D</sub> = V <sub>R</sub> = 0V |
|                    |                                        | 3875·10 <sup>3</sup> A <sup>2</sup> s | tp                                    | = | 8.3 ms |                                      |
| V <sub>F0</sub>    | Threshold voltage                      | 0.84 V                                | I <sub>F</sub> = 2000 - 6000 A        |   |        | T <sub>j</sub> = 160°C               |
| r <sub>F</sub>     | Slope resistance                       | 0.13 mΩ                               |                                       |   |        |                                      |
| V <sub>F min</sub> | On-state voltage                       | 1.20 V                                | I <sub>F</sub> = 4000 A               |   |        | T <sub>j</sub> = 25°C                |
| V <sub>F max</sub> | On-state voltage                       | 1.35 V                                |                                       |   |        |                                      |

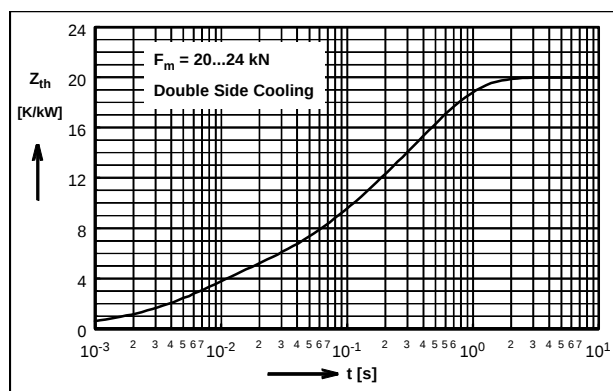
## Thermal

|            |                                                  |             |                     |
|------------|--------------------------------------------------|-------------|---------------------|
| $T_j$      | Storage and operating junction temperature range | -40...160°C |                     |
| $R_{thJC}$ | Thermal resistance junction to case              | 40 K/kW     | Anode side cooled   |
|            |                                                  | 40 K/kW     | Cathode side cooled |
|            |                                                  | 20 K/kW     | Double side cooled  |
| $R_{thCH}$ | Thermal resistance case to heat sink             | 10 K/kW     | Single side cooled  |
|            |                                                  | 5 K/kW      | Double side cooled  |

Analytical function for transient thermal impedance:

$$Z_{thJC}(t) = \sum_{i=1}^4 R_i(1 - e^{-t/\tau_i})$$

| i                    | 1     | 2     | 3    | 4      |
|----------------------|-------|-------|------|--------|
| $R \text{ (K/kW)}$   | 11.83 | 4.26  | 1.63 | 2.28   |
| $\tau_i \text{ (s)}$ | 0.432 | 0.071 | 0.01 | 0.0054 |



For a given case temperature  $T_c$  at ambient temperature  $T_a$  the maximum on-state current can be calculated as follows:

$$I_{FAVM} = \frac{-V_{F0} + \sqrt{(V_{F0})^2 + 4 \cdot f^2 \cdot r_f \cdot P}}{2 \cdot f^2 \cdot r_f}$$

$$\text{where } P = \frac{T_{J \max} - T_C}{R_{thjc}} \text{ or } P = \frac{T_{J \max} - T_A}{R_{thja}}$$

|                                     |                                |                                |                               |
|-------------------------------------|--------------------------------|--------------------------------|-------------------------------|
| $I_{FAVM} \text{ (A)}$              | $P \text{ (W)}$                | $V_{F0} \text{ (V)}$           | $r_f \text{ (}\Omega\text{)}$ |
| $T_{\max} \text{ (}^\circ\text{C)}$ | $T_c \text{ (}^\circ\text{C)}$ | $T_a \text{ (}^\circ\text{C)}$ |                               |
| $R_{thja} \text{ (K/kW)}$           | $R_{thJC} \text{ (K/kW)}$      |                                |                               |
| $f^2 =$                             | 1                              | for DC current                 |                               |
|                                     | 2.5                            | for half-sine wave             |                               |
|                                     | 3.1                            | for 120° el., sine             |                               |
|                                     | 6                              | for 60° el., sine              |                               |