

$V_{DSM} = 1800 \text{ V}$   
 $I_{TAVM} = 1660 \text{ A}$   
 $I_{TRMS} = 2610 \text{ A}$   
 $I_{TSM} = 21000 \text{ A}$   
 $V_{T0} = 0.83 \text{ V}$   
 $r_T = 0.230 \text{ m}\Omega$

# Phase Control Thyristor

## 5STP 18F1800

Doc. No. 5SYA1028-04 Sep. 01

- Patented free-floating silicon technology
- Low on-state and switching losses
- Designed for traction, energy and industrial applications
- Optimum power handling capability

### Blocking

| Part Number         | 5STP 18F1800          | 5STP 18F1600 | 5STP 18F1200 | Conditions  |
|---------------------|-----------------------|--------------|--------------|---|
| $V_{DRM}$ $V_{RRM}$ | 1800 V                | 1600 V       | 1200 V       | $f = 50 \text{ Hz}$ , $t_p = 10\text{ms}$                 |
| $V_{RSM1}$          | 2000 V                | 1800 V       | 1400 V       | $t_p = 5\text{ms}$ , single pulse                         |
| $I_{DRM}$           | $\leq 200 \text{ mA}$ |              |              | $V_{DRM}$<br>$V_{RRM}$<br>$T_j = 125^\circ\text{C}$       |
| $I_{RRM}$           | $\leq 200 \text{ mA}$ |              |              |   |
| $dV/dt_{crit}$      | 1000 V/ $\mu\text{s}$ |              |              | Exp. to $0.67 \times V_{DRM}$ , $T_j = 125^\circ\text{C}$ |

### Mechanical data

|       |                           |      |                     |
|-------|---------------------------|------|---------------------|
| $F_M$ | Mounting force            | nom. | 22 kN               |
|       |                           | min. | 14 kN               |
|       |                           | max. | 24 kN               |
| a     | Acceleration              |      |                     |
|       | Device unclamped          |      | $50 \text{ m/s}^2$  |
|       | Device clamped            |      | $100 \text{ m/s}^2$ |
| m     | Weight                    |      | 0.6 kg              |
| $D_S$ | Surface creepage distance |      | 25 mm               |
| $D_a$ | Air strike distance       |      | 14 mm               |

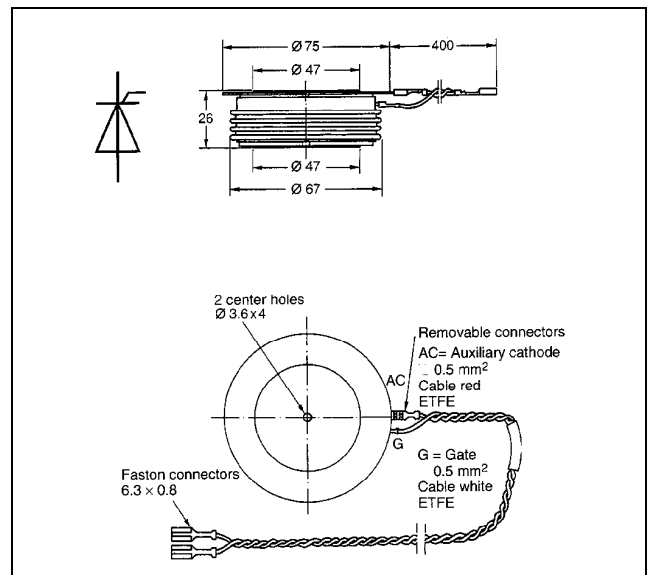


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## On-state

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|            |                               |                            |  |                           |
|------------|-------------------------------|----------------------------|--|---------------------------|
| $I_{TAVM}$ | Max. average on-state current | 1660 A                     | Half sine wave, $T_C = 70^\circ\text{C}$ |                           |
| $I_{TRMS}$ | Max. RMS on-state current     | 2610 A                     |  |                           |
| $I_{TSM}$  | Max. peak non-repetitive      | 21000 A                    | $t_p = 10\text{ ms}$                     | $T_j = 125^\circ\text{C}$ |
|            | surge current                 | 22000 A                    | $t_p = 8.3\text{ ms}$                    | After surge:              |
| $I^2t$     | Limiting load integral        | 2205 $\text{kA}^2\text{s}$ | $t_p = 10\text{ ms}$                     | $V_D = V_R = 0\text{V}$   |
|            |                               | 2008 $\text{kA}^2\text{s}$ | $t_p = 8.3\text{ ms}$                    |                           |
| $V_T$      | On-state voltage              | 1.30 V                     | $I_T = 2000\text{ A}$                    | $T_j = 125^\circ\text{C}$ |
| $V_{T0}$   | Threshold voltage             | 0.83 V                     | $I_T = 1000 - 3000\text{ A}$             |                           |
| $r_T$      | Slope resistance              | 0.230 $\text{m}\Omega$     |  |                           |
| $I_H$      | Holding current               | 20-70 mA                   | $T_j = 25^\circ\text{C}$                 |                           |
|            |                               | 15-60 mA                   | $T_j = 125^\circ\text{C}$                |                           |
| $I_L$      | Latching current              | 100- mA                    | $T_j = 25^\circ\text{C}$                 |                           |
|            |                               | 50-200 mA                  | $T_j = 125^\circ\text{C}$                |                           |

## Switching

|                |   |                            |   |  |
|----------------|---|----------------------------|---|--|
| $di/dt_{crit}$ | Critical rate of rise of on-state current | 150 $\text{A}/\mu\text{s}$ | Cont. $f = 50\text{ Hz}$  | $V_D \leq 0.67 \cdot V_{DRM}$ , $T_j = 125^\circ\text{C}$<br>$I_{TRM} = 2000\text{ A}$<br>$I_{FG} = 2\text{ A}$ , $t_r = 0.5\ \mu\text{s}$ |
|                |   | 300 $\text{A}/\mu\text{s}$ | 60 sec.<br>$f = 50\text{ Hz}$                                       |  |
| $t_d$          | Delay time                                | $\leq 3.0\ \mu\text{s}$    | $V_D = 0.4 \cdot V_{DRM}$   | $I_{FG} = 2\text{ A}$ , $t_r = 0.5\ \mu\text{s}$   |
| $t_q$          | Turn-off time                             | $\leq 400\ \mu\text{s}$    | $V_D \leq 0.67 \cdot V_{DRM}$<br>$dv_D/dt = 20\text{V}/\mu\text{s}$ | $I_{TRM} = 2000\text{ A}$ , $T_j = 125^\circ\text{C}$<br>$V_R > 200\text{ V}$ , $di_T/dt = -20\text{ A}/\mu\text{s}$                       |
| $Q_{rr}$       | Recovery charge                           | min                        | 2500 $\mu\text{As}$   |  |
|                |   | max                        | 4500 $\mu\text{As}$   |  |

## Triggering

|           |                           |        |                            |
|-----------|---------------------------|--------|----------------------------|
| $V_{GT}$  | Gate trigger voltage      | 2.6 V  | $T_j = 25^\circ$           |
| $I_{GT}$  | Gate trigger current      | 400 mA | $T_j = 25^\circ$           |
| $V_{GD}$  | Gate non-trigger voltage  | 0.3 V  | $V_D = 0.4 \times V_{DRM}$ |
| $I_{GD}$  | Gate non-trigger current  | 10 mA  | $V_D = 0.4 \times V_{DRM}$ |
| $V_{FGM}$ | Peak forward gate voltage | 12 V   |                            |
| $I_{FGM}$ | Peak forward gate current | 10 A   |                            |
| $V_{RGM}$ | Peak reverse gate voltage | 10 V   |                            |
| $P_G$     | Gate power loss           | 3 W    |                            |

# Thermal

|                   |  |              |                     |
|-------------------|--|--------------|---------------------|
| T <sub>op</sub>   | Max operating junction temperature range | 125 °C       |                     |
| T <sub>stg</sub>  | Storage temperature range                | -40...140 °C |                     |
| R <sub>thJC</sub> | Thermal resistance junction to case      | 33 K/kW      | Anode side cooled   |
|                   |  | 35 K/kW      | Cathode side cooled |
|                   |  | 17 K/kW      | Double side cooled  |
| R <sub>thCH</sub> | Thermal resistance case to heat sink     | 8 K/kW       | Single side cooled  |
|                   |  | 4 K/kW       | Double side cooled  |

Analytical function for transient thermal impedance:

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

|                       |        |        |        |        |
|-----------------------|--------|--------|--------|--------|
| i                     | 1      | 2      | 3      | 4      |
| R <sub>i</sub> (K/kW) | 10.35  | 3.76   | 2.29   | 0.67   |
| τ <sub>i</sub> (s)    | 0.3723 | 0.0525 | 0.0057 | 0.0023 |

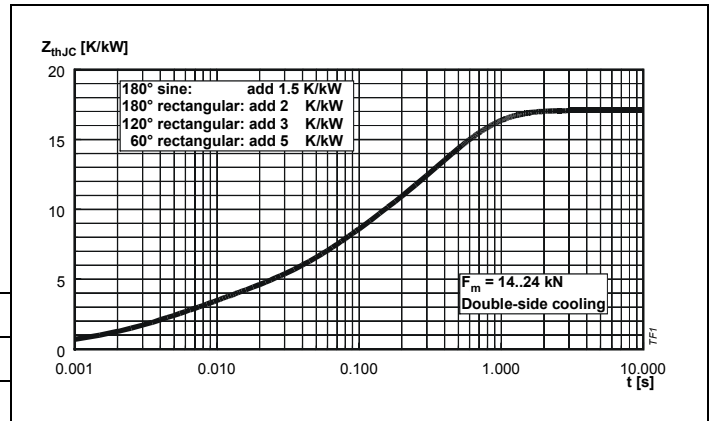


Fig. 1 Transient thermal impedance junction to case.

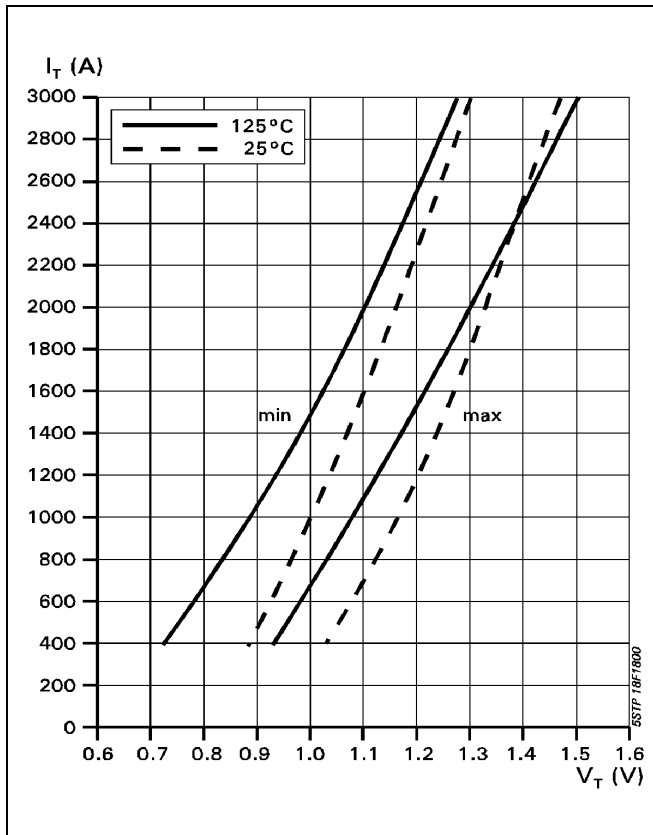


Fig. 2 On-state characteristics.

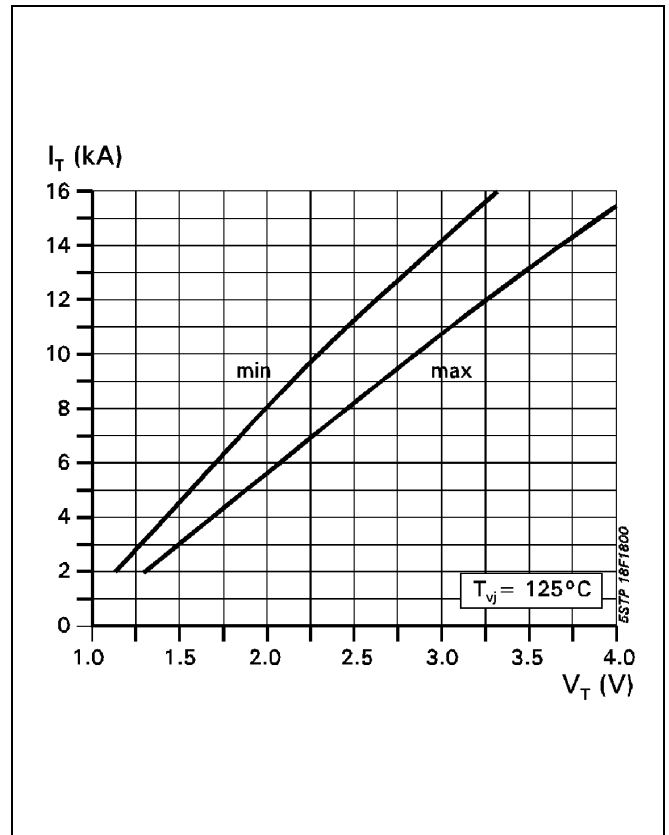


Fig. 3 On-state characteristics. T<sub>vj</sub>=125°C, 10ms half sine

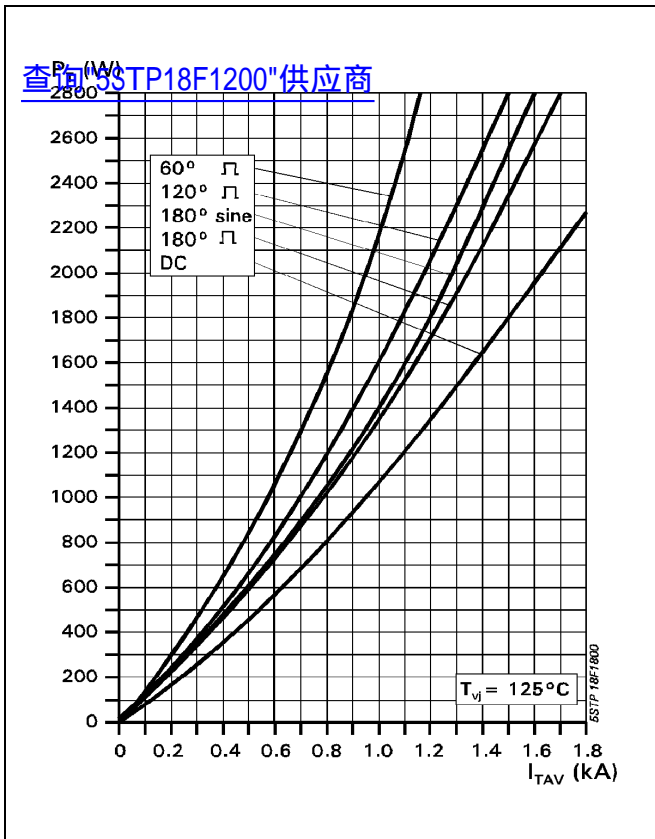


Fig. 4 On-state power dissipation vs. mean on-state current. Turn - on losses excluded.

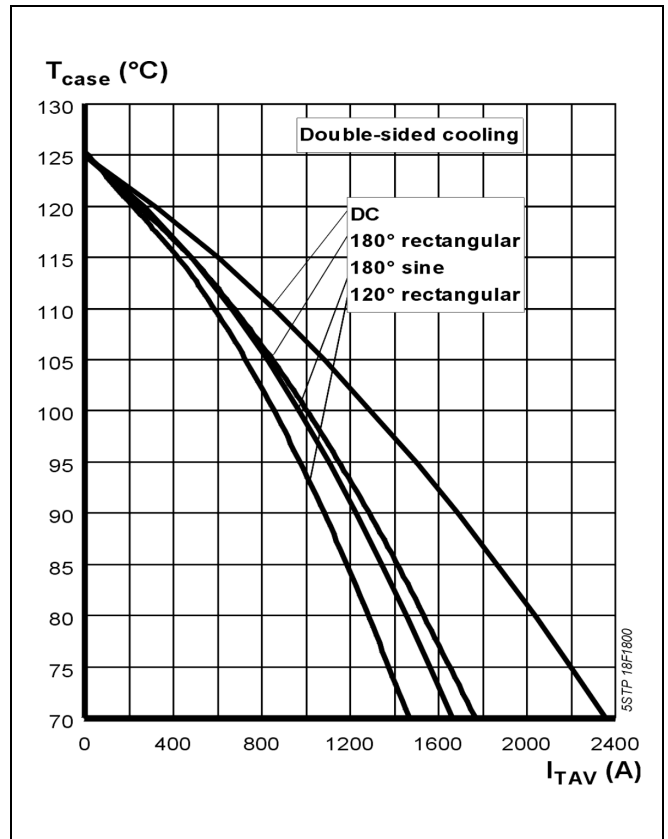


Fig. 5 Max. permissible case temperature vs. mean on-state current.

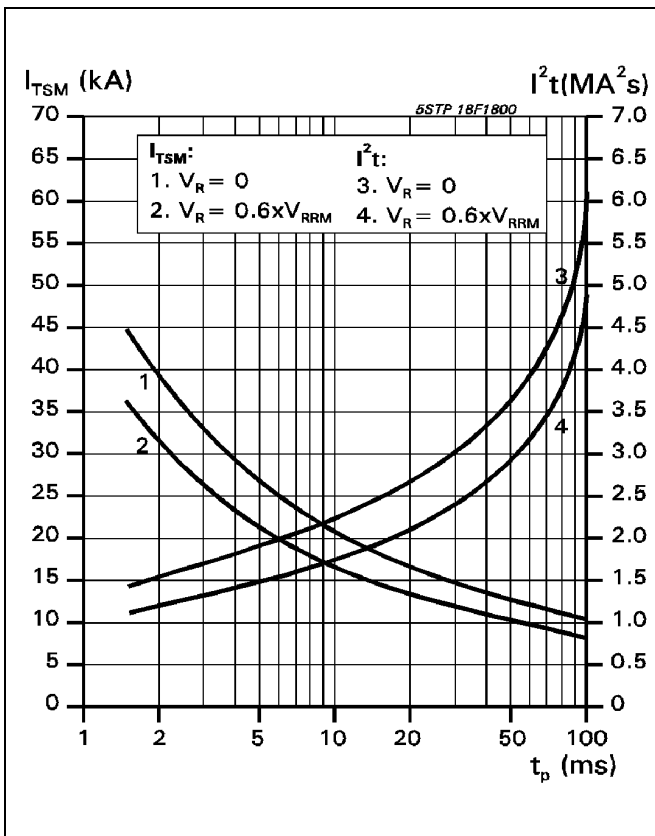


Fig. 6 Surge on-state current vs. pulse length. Half-sine wave.

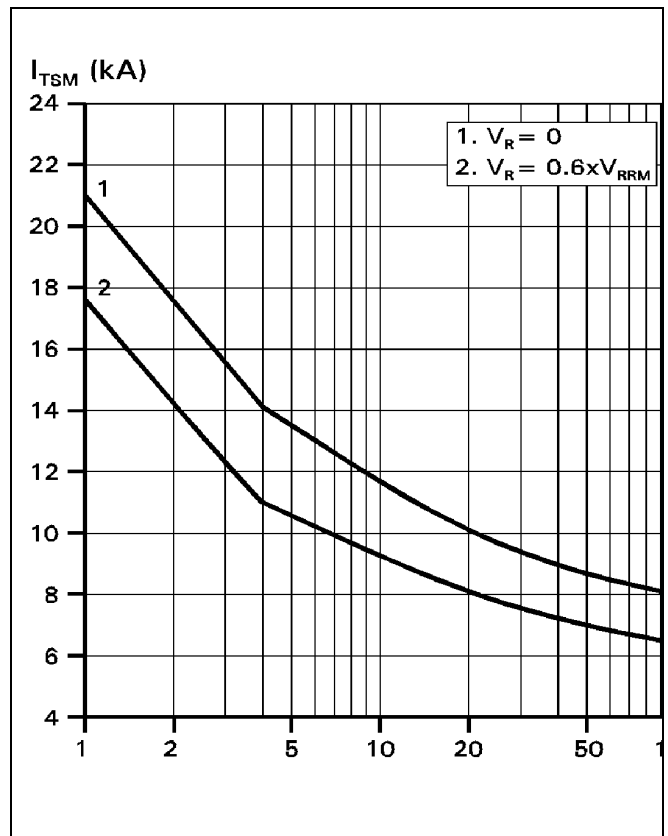


Fig. 7 Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.

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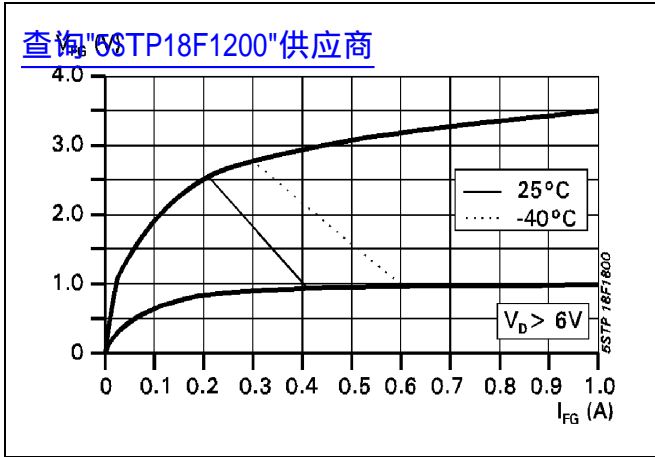


Fig. 8 Gate trigger characteristics.

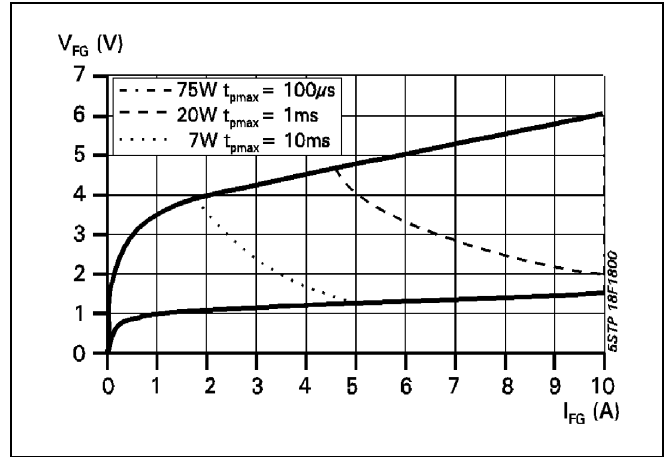


Fig. 9 Max. peak gate power loss.

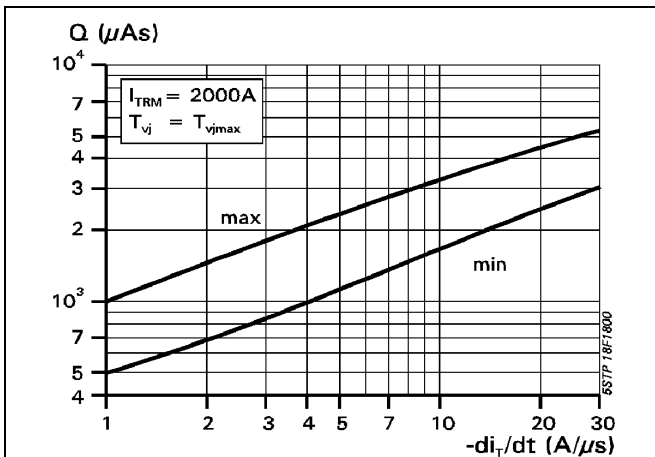


Fig. 10 Recovery charge vs. decay rate of on-state current.

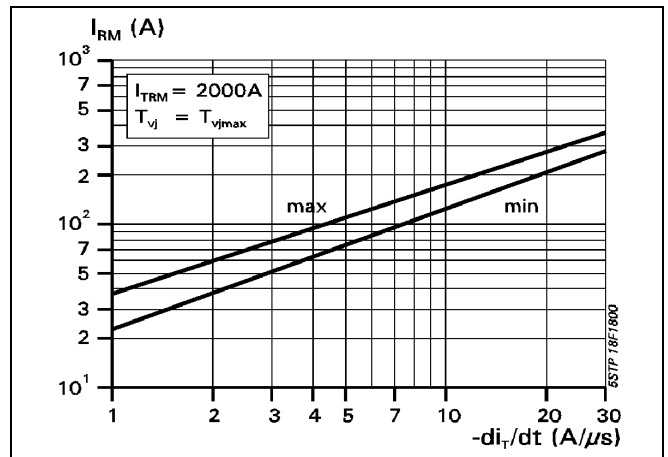


Fig. 11 Peak reverse recovery current vs. decay rate of on-state current.

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