

Rectifier Diode D133-1000-20



| | | | | | | | | | | | | | |
|---------------------------------|-----------|-----|-----|-----|-----|-----|-----------|------|--------------|------|------|------|--|
| Average forward current | | | | | | | I_{FAV} | | 1000 A | | | | |
| Repetitive peak reverse voltage | | | | | | | V_{RRM} | | 400 - 2000 V | | | | |
| V_{RRM}, B | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1200 | 1400 | 1600 | 1800 | 2000 | |
| Voltage code | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 14 | 16 | 18 | 20 | |
| $T_j, ^\circ C$ | -60 ÷ 175 | | | | | | | | | | | | |

MAXIMUM ALLOWABLE RATINGS

| Symbols and parameters | | Units | Values | Test conditions | |
|------------------------|---|-------------------|---------------------|--|--|
| ON-STATE | | | | | |
| I_{FAV} | Maximum allowable average forward current | A | 1000 1331 | $T_c=131\text{ }^\circ C$; Double side cooled; $T_c=100\text{ }^\circ C$; Double side cooled; 180° half-sine wave; 50 Hz | |
| I_{FRMS} | RMS forward current | A | 1570 | $T_c=131\text{ }^\circ C$; Double side cooled; 180° half-sine wave; 50 Hz | |
| I_{FSM} | Surge forward current | kA | 15.0 17.0 | $T_j=T_{j\max}$ $T_j=25\text{ }^\circ C$ | 180° half-sine wave; $t_p=10\text{ ms}$; single pulse; $V_R=0\text{ V}$ |
| | | | 16.0 19.0 | $T_j=T_{j\max}$ $T_j=25\text{ }^\circ C$ | 180° half-sine wave; $t_p=8.3\text{ ms}$; single pulse; $V_R=0\text{ V}$ |
| I^2t | Safety factor | $A^2s \cdot 10^3$ | 1100 1400 | $T_j=T_{j\max}$ $T_j=25\text{ }^\circ C$ | 180° half-sine wave; $t_p=10\text{ ms}$; single pulse; $V_R=0\text{ V}$ |
| | | | 1000 1400 | $T_j=T_{j\max}$ $T_j=25\text{ }^\circ C$ | 180° half-sine wave; $t_p=8.3\text{ ms}$; single pulse; $V_R=0\text{ V}$ |
| BLOCKING | | | | | |
| V_{RRM} | Repetitive peak reverse voltages | V | 1000...1800 | $T_{j\min} < T_j < T_{j\max}$; 180° half-sine wave; 50 Hz | |
| V_{RSM} | Non-repetitive peak reverse voltages | V | 1100...1900 | $T_{j\min} < T_j < T_{j\max}$; 180° half-sine wave; single pulse | |
| V_R | Reverse continuous voltages | V | $0.6 \cdot V_{RRM}$ | $T_j=T_{j\max}$ | |
| THERMAL | | | | | |
| T_{stg} | Storage temperature | $^\circ C$ | -60...+50 | | |
| T_j | Operating junction temperature | $^\circ C$ | -60...+175 | | |
| MECHANICAL | | | | | |
| F | Mounting force | kN | 9.0...11.0 | | |
| a | Acceleration | m/s^2 | 50 | Device clamped | |

CHARACTERISTICS

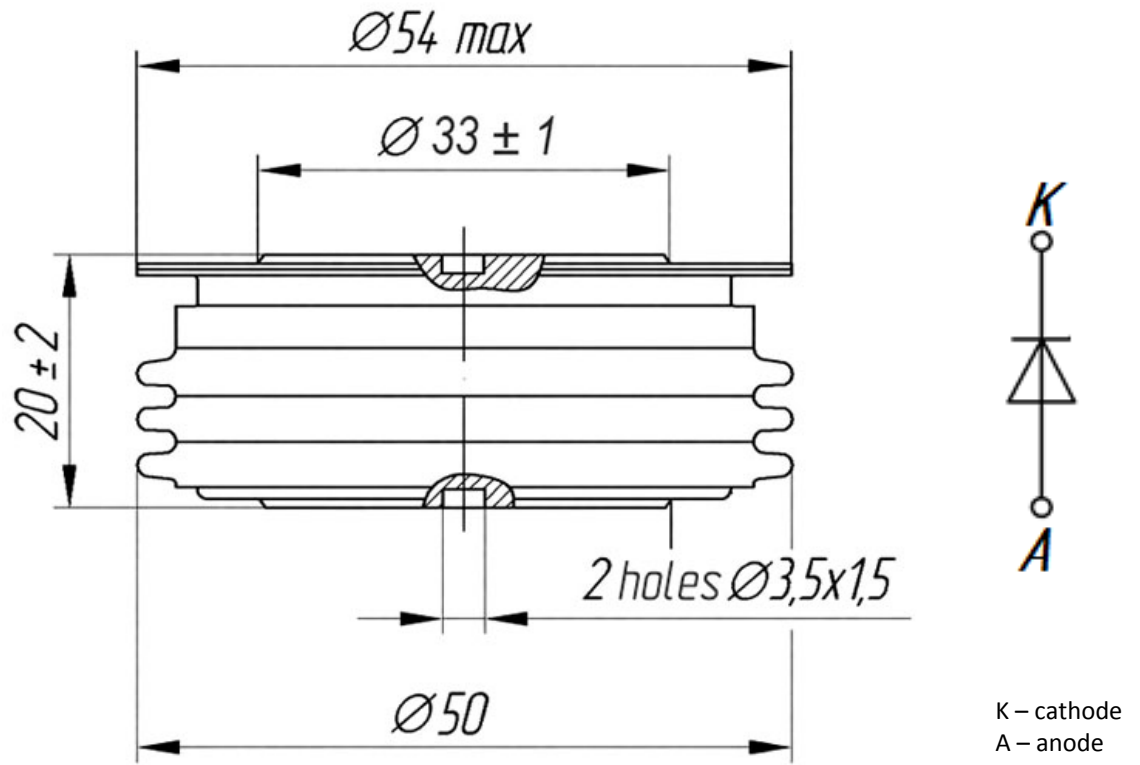
| Symbols and parameters | | Units | Values | Conditions | |
|------------------------|---|--------------------|------------------|---|---------------------|
| ON-STATE | | | | | |
| V_{FM} | Peak forward voltage, max | V | 1.60 | $T_j=25\text{ }^\circ\text{C}; I_{FM}=3140\text{ A}$ | |
| $V_{F(TO)}$ | Forward threshold voltage, max | V | 0.828 | $T_j=T_{j\text{max}};$ $0.5\text{ p } I_{FAV} < I_T < 1.5\text{ p } I_{FAV}$ | |
| r_T | Forward slope resistance, max | mW | 0.264 | | |
| BLOCKING | | | | | |
| I_{RRM} | Repetitive peak reverse current, max | mA | 50 | $T_j=T_{j\text{max}};$ $V_R=V_{RRM}$ | |
| SWITCHING | | | | | |
| Q_{rr} | Total recovered charge, max | mC | 1490 | $T_j=175\text{ }^\circ\text{C}; I_{TM}=1000\text{ A}; di_R/$ $dt=-10\text{ A/ms};$ $V_R=100\text{ V}$ | |
| t_{rr} | Reverse recovery time, max | ms | 22 | | |
| I_{rr} | Reverse recovery current, max | A | 135 | | |
| THERMAL | | | | | |
| R_{thjc} | Thermal resistance, junction to case, max | $^\circ\text{C/W}$ | 0.040 | Direct current | Double side cooled |
| R_{thjc-A} | | | 0.088 | | Anode side cooled |
| R_{thjc-K} | | | 0.072 | | Cathode side cooled |
| R_{thck} | Thermal resistance, case to heatsink, max | $^\circ\text{C/W}$ | 0.009 | Direct current | |
| MECHANICAL | | | | | |
| m | Weight, max | g | 110 | | |
| D_s | Surface creepage distance | mm (inch) | 11.10 (0.437) | | |
| D_a | Air strike distance | mm (inch) | 11.60 (0.457) | | |

PART NUMBERING GUIDE

D 133 1000
1 2 3

1. D — Rectifier Diode
2. Design version
3. Average forward current, A

Package type: PD32



All dimensions in millimeters

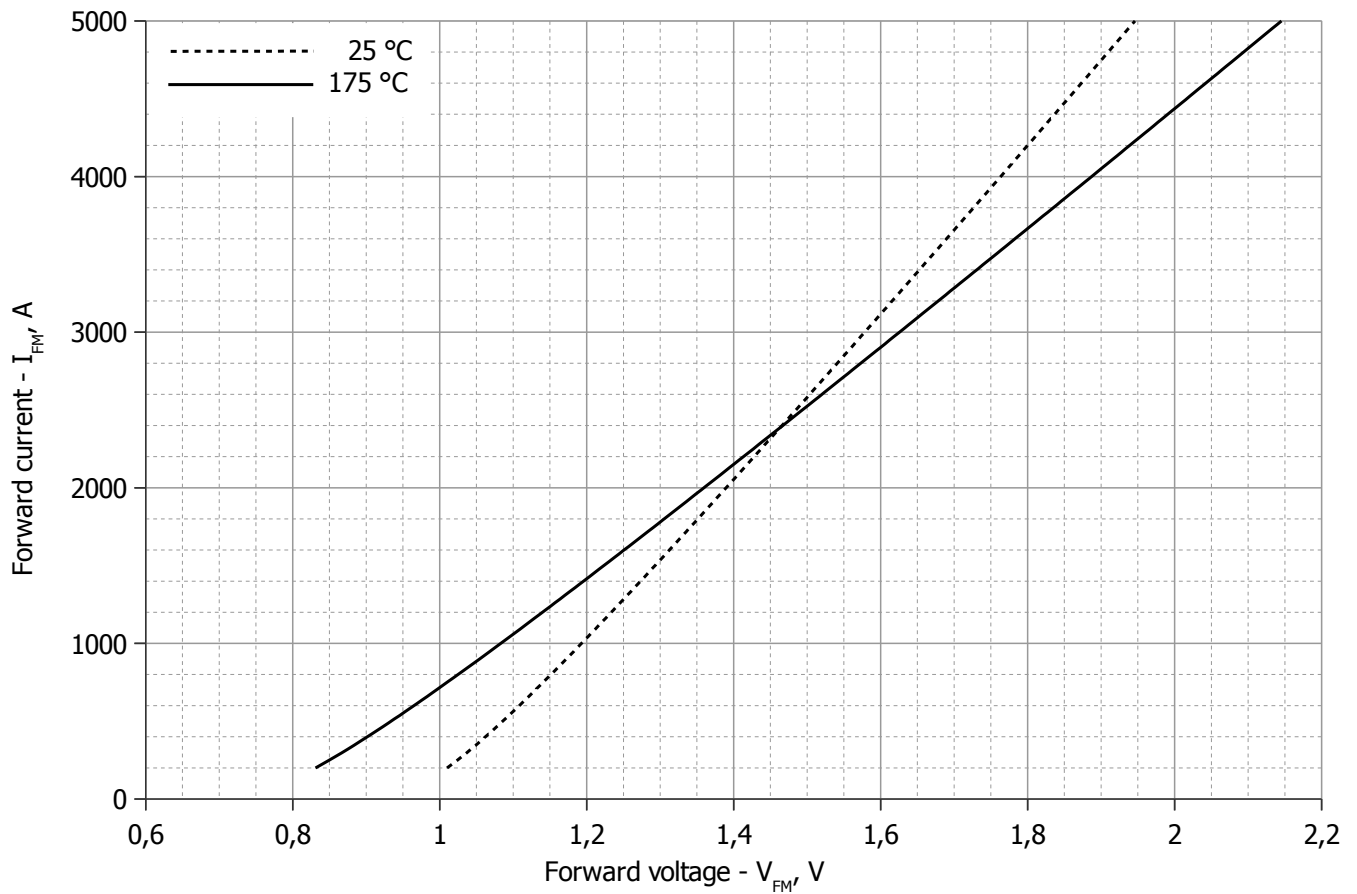


Fig 1 – Forward characteristics of Limit device

Analytical function for Forward characteristic:

$$V_F = A + B \cdot i_F + C \cdot \ln(i_F + 1) + D \cdot \sqrt{i_F}$$

| | Coefficients for max curves | |
|----------|-----------------------------|-------------------------|
| | $T_j = 25^\circ\text{C}$ | $T_j = T_{j\text{max}}$ |
| A | 0.87053707 | 0.66646454 |
| B | 0.00017096 | 0.00024102 |
| C | 0.01700686 | 0.01710227 |
| D | 0.00107341 | 0.00181251 |

Forward characteristic model (see Fig. 1).

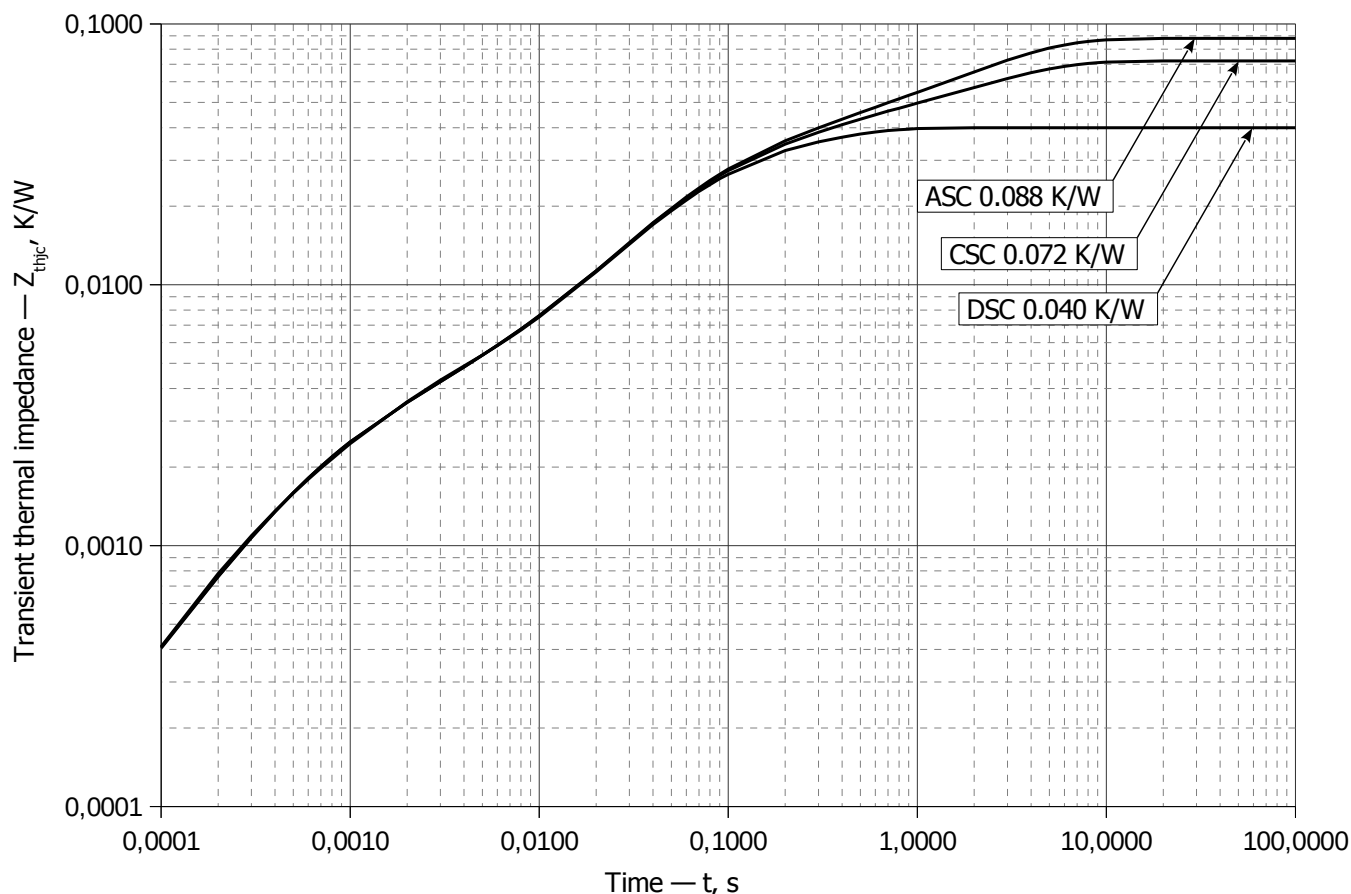


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

Analytical function for Transient thermal impedance junction to case Z_{thjc} for DC:

$$Z_{thjc} = \sum_{i=1}^n R_i \left(1 - e^{-\frac{t}{\tau_i}} \right)$$

Where $i = 1$ to n , n is the number of terms in the series.

t = Duration of heating pulse in seconds.

Z_{thjc} = Thermal resistance at time t .

R_i = Amplitude of p_{th} term.

τ_i = Time constant of r_{th} term.

DC Double side cooled

| i | 1 | 2 | 3 | 4 | 5 | 6 |
|--------------|----------|----------|----------|----------|-------------|-----------|
| R_i , K/W | 0.01423 | 0.01906 | 0.003576 | 0.002535 | -4.666e-005 | 0.0006479 |
| τ_i , s | 0.265 | 0.05901 | 0.03499 | 0.001252 | 0.000001 | 0.0002488 |

DC Cathode side cooled

| i | 1 | 2 | 3 | 4 | 5 | 6 |
|--------------|----------|----------|----------|----------|----------|-----------|
| R_i , K/W | 0.03216 | 0.01306 | 0.002934 | 0.02064 | 0.001493 | 0.001786 |
| τ_i , s | 2.647 | 0.2831 | 0.1455 | 0.05284 | 0.002255 | 0.0005519 |

DC Anode side cooled

| i | 1 | 2 | 3 | 4 | 5 | 6 |
|--------------|----------|----------|----------|----------|----------|-----------|
| R_i , K/W | 0.04804 | 0.001789 | 0.01342 | 0.02147 | 0.001374 | 0.001945 |
| τ_i , s | 2.651 | 0.4195 | 0.2622 | 0.05451 | 0.002585 | 0.0005847 |

Transient thermal impedance junction to case Z_{thjc} model (see Fig. 2)

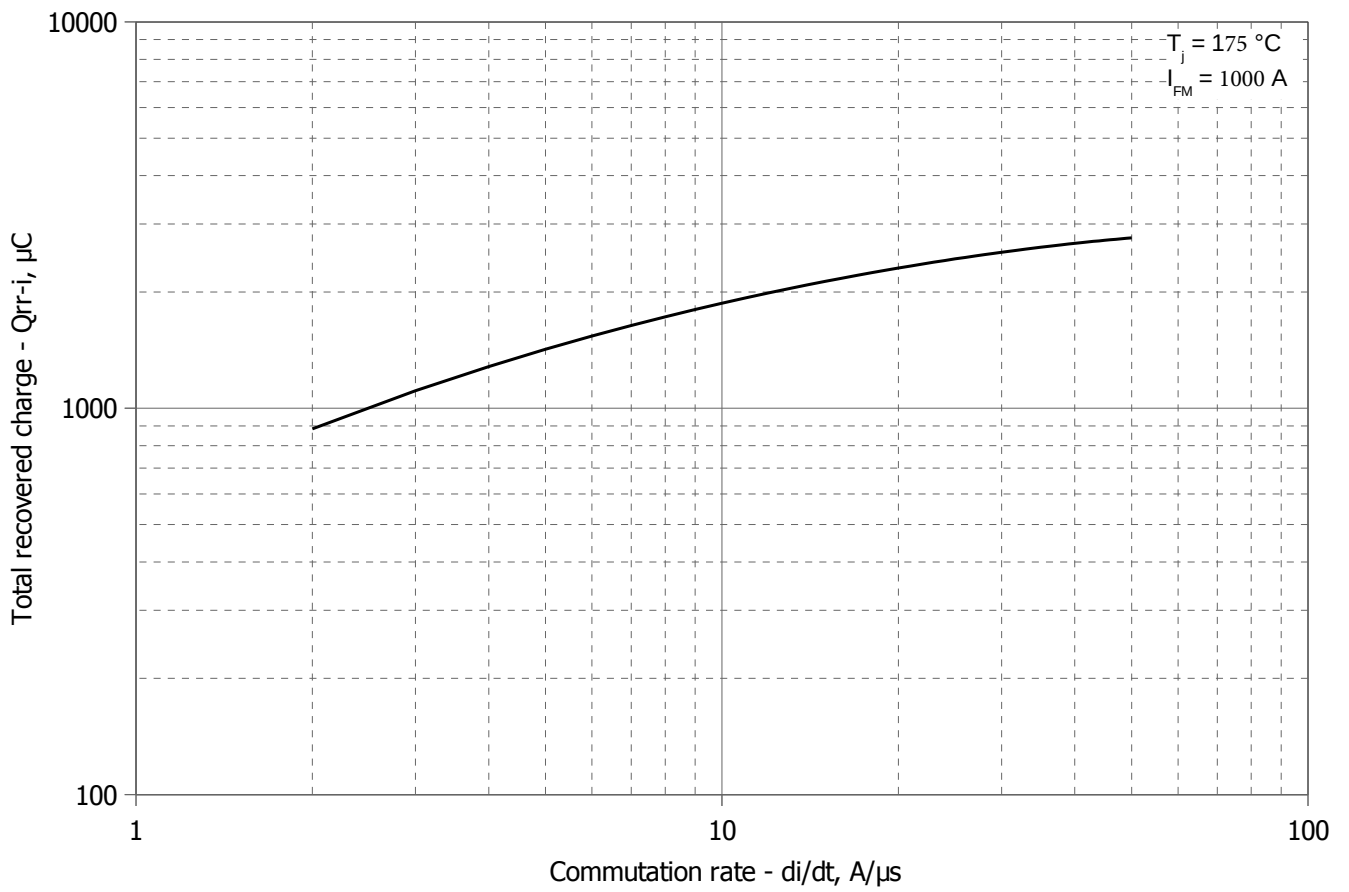


Fig 3 - Total recovered charge Q_{rr-i} (integral) vs. commutation rate di_R/dt

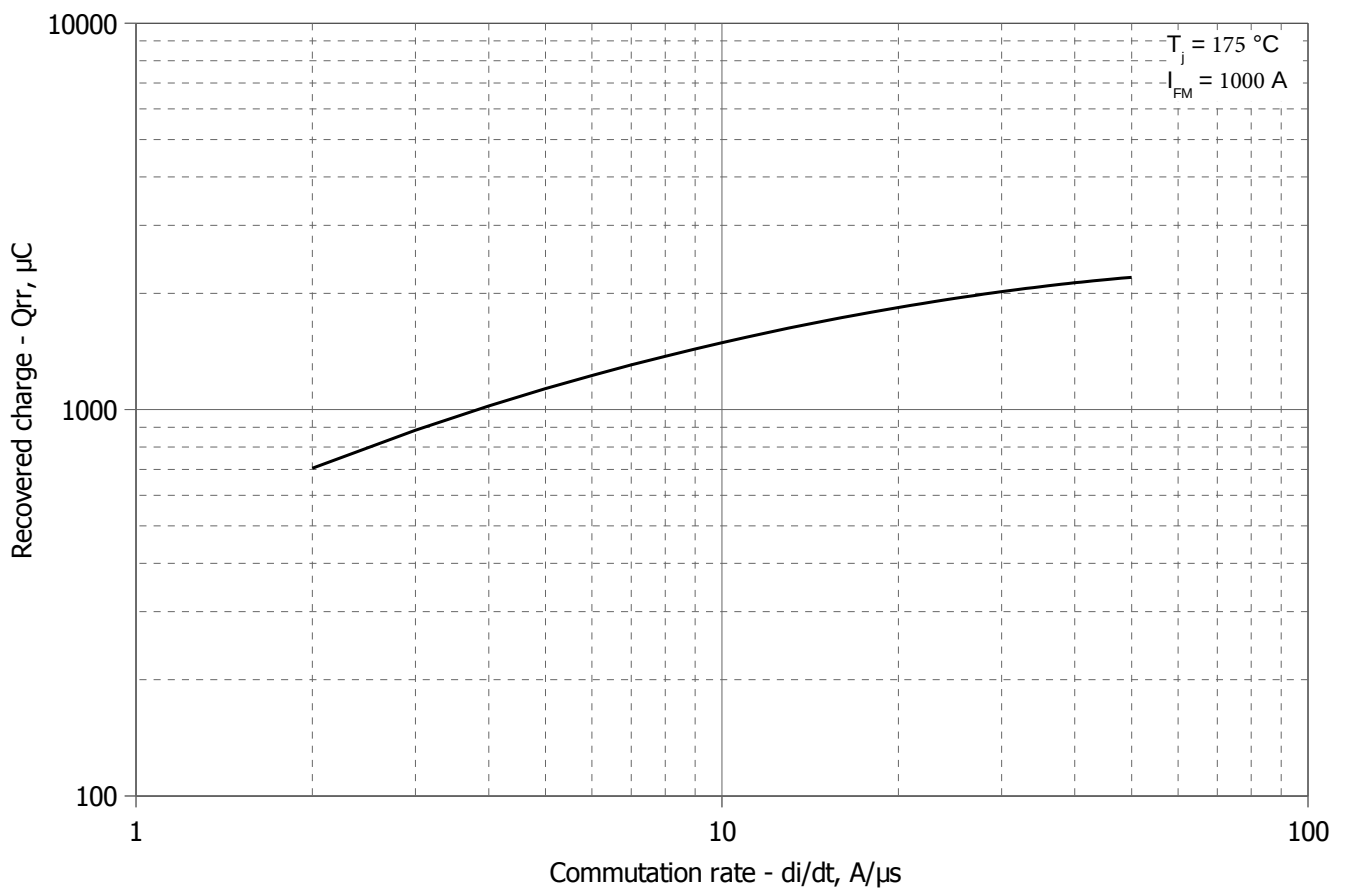


Fig 4 - Maximum recovered charge Q_{rr} vs. commutation rate di_R/dt (25% chord)

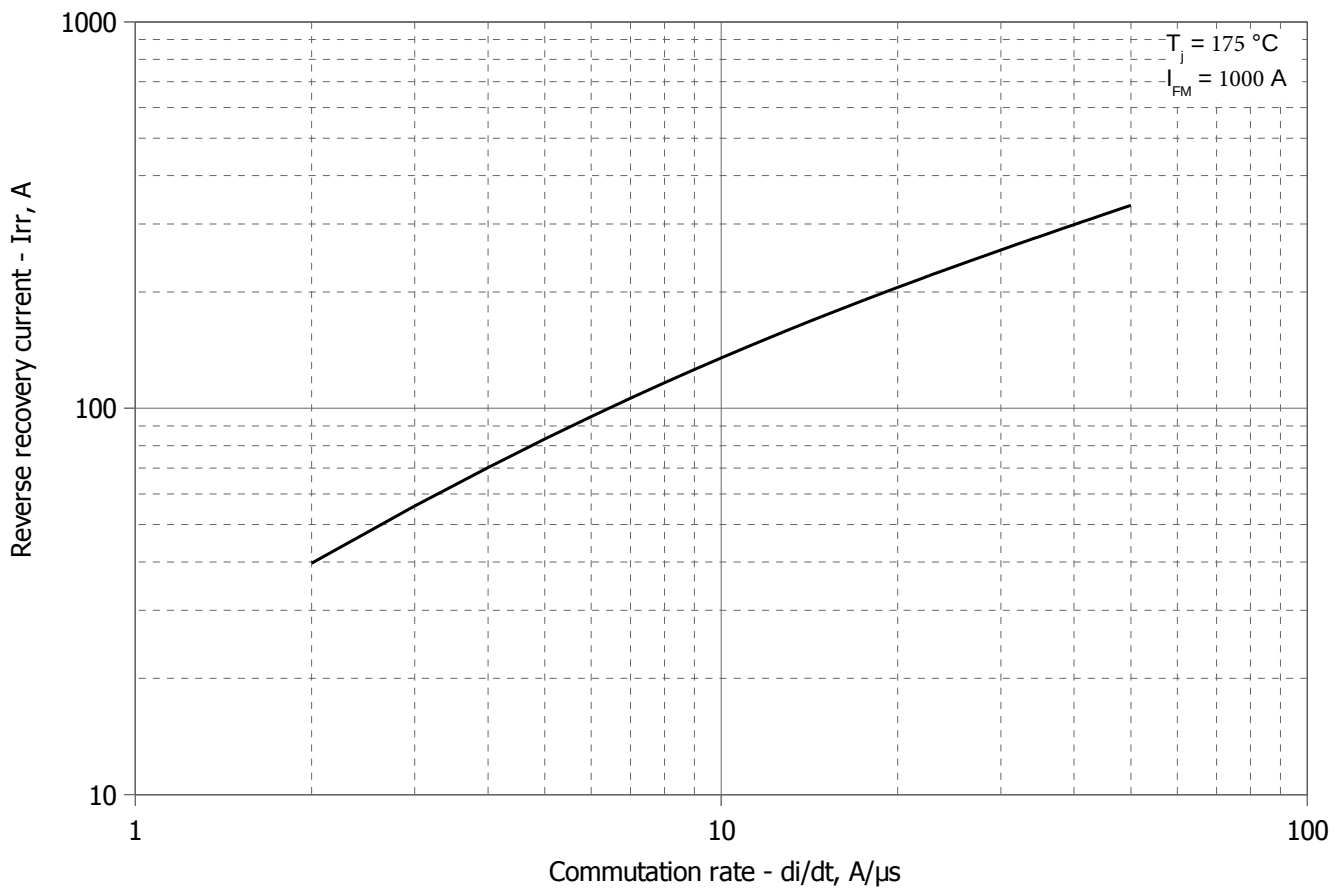


Fig 5 - Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt

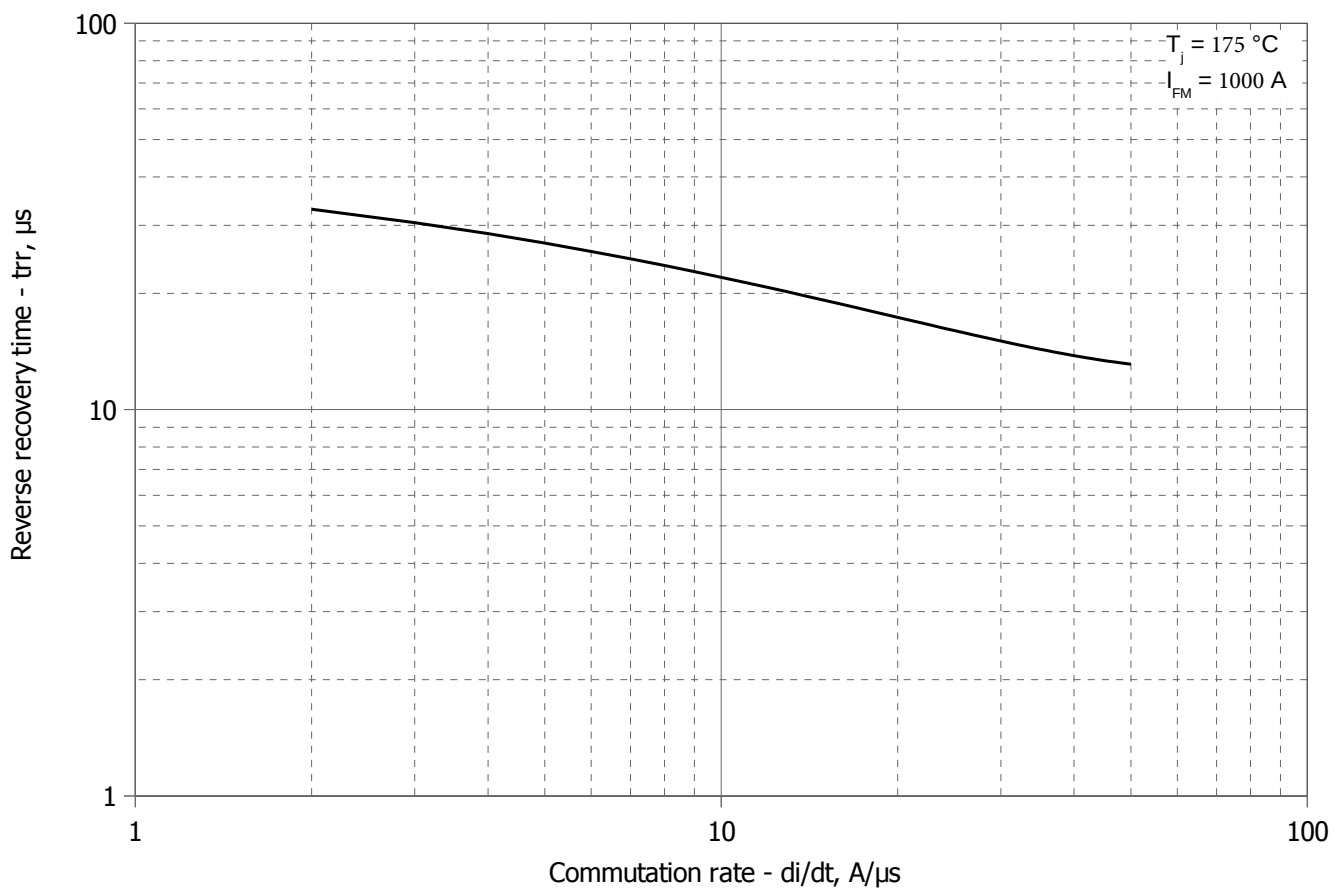


Fig 6 - Maximum recovery time t_r vs. commutation rate di_R/dt (25% chord)

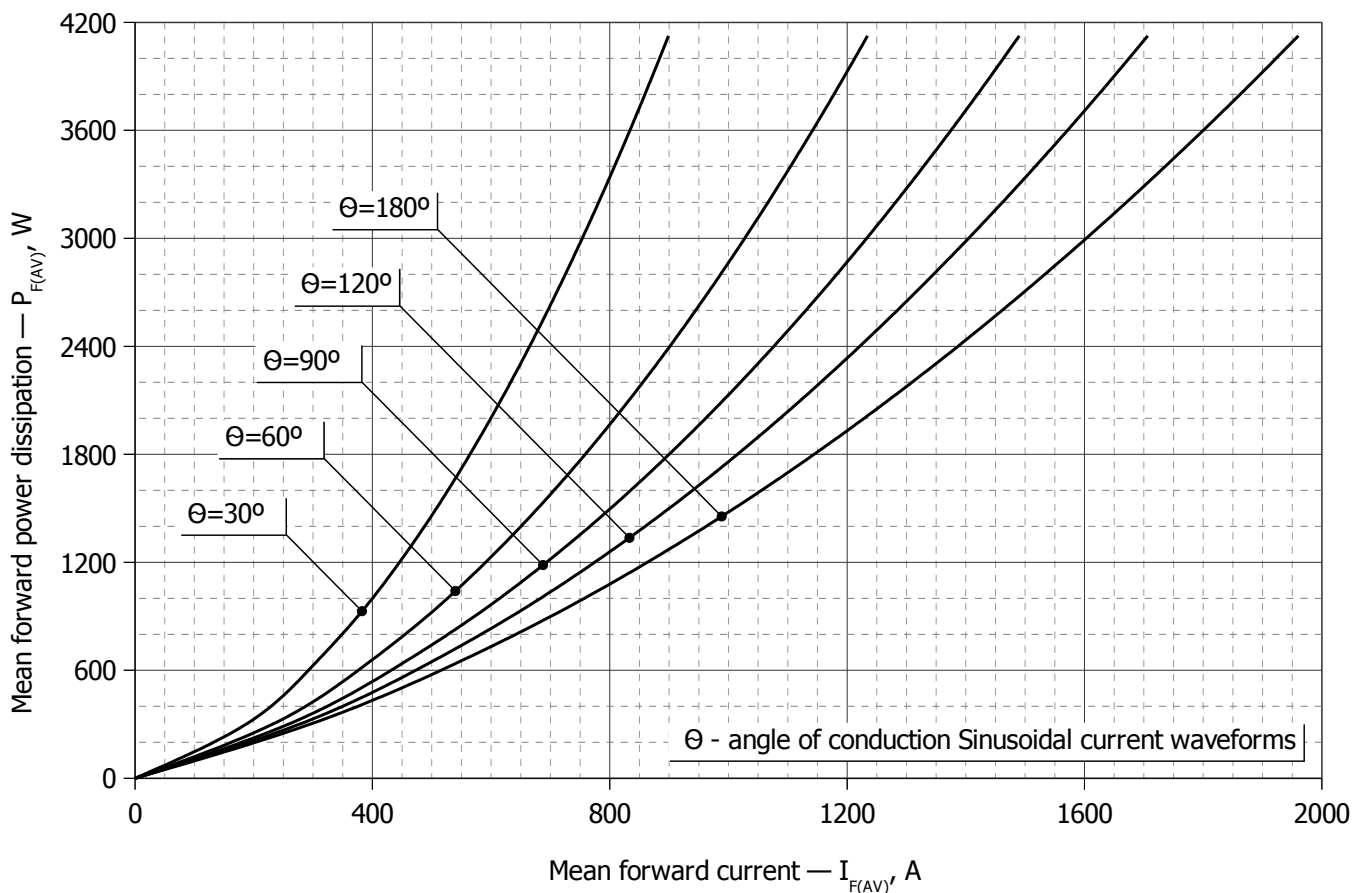


Fig. 7 - Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$, DSC)

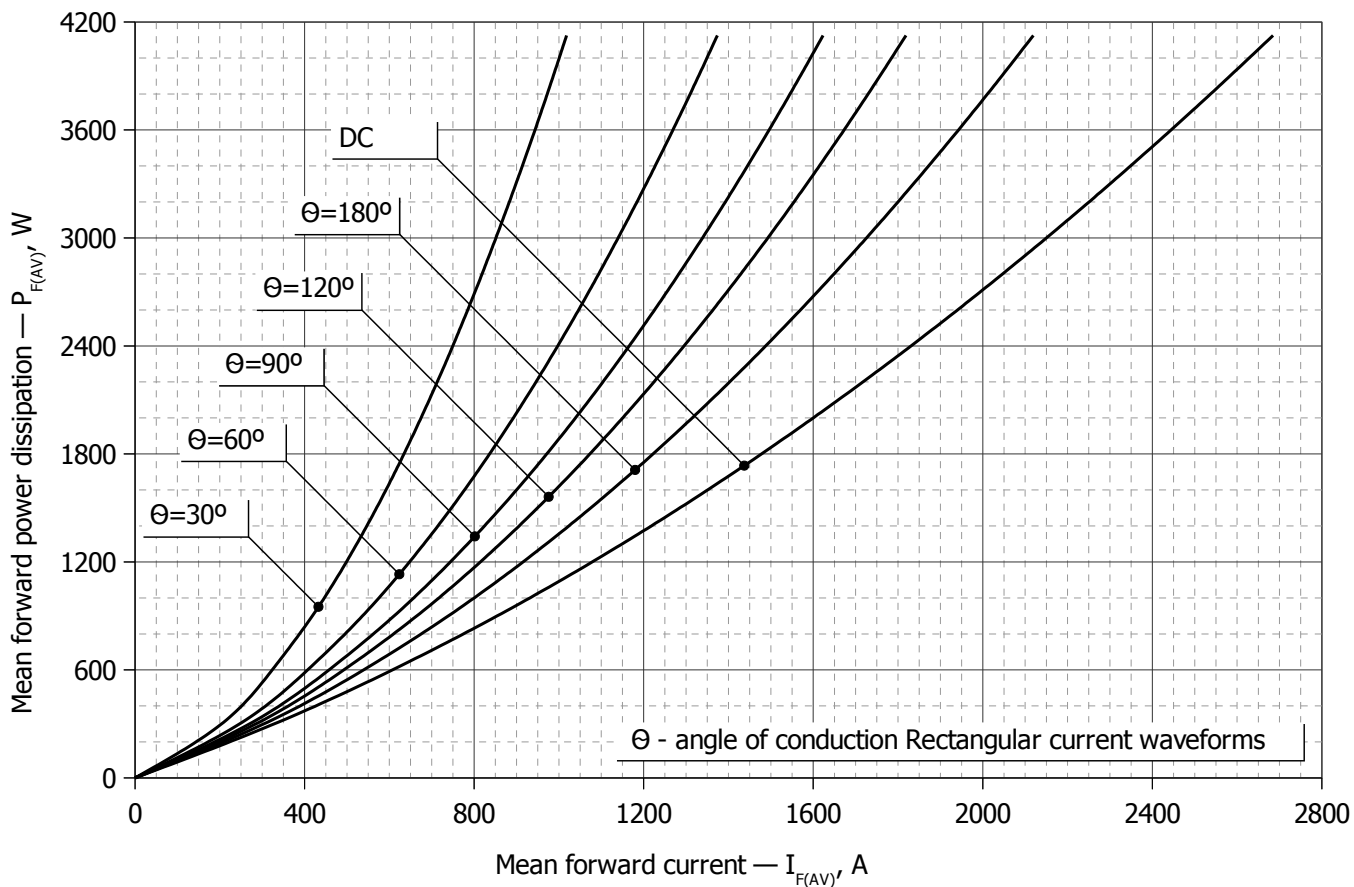


Fig. 8 - Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)

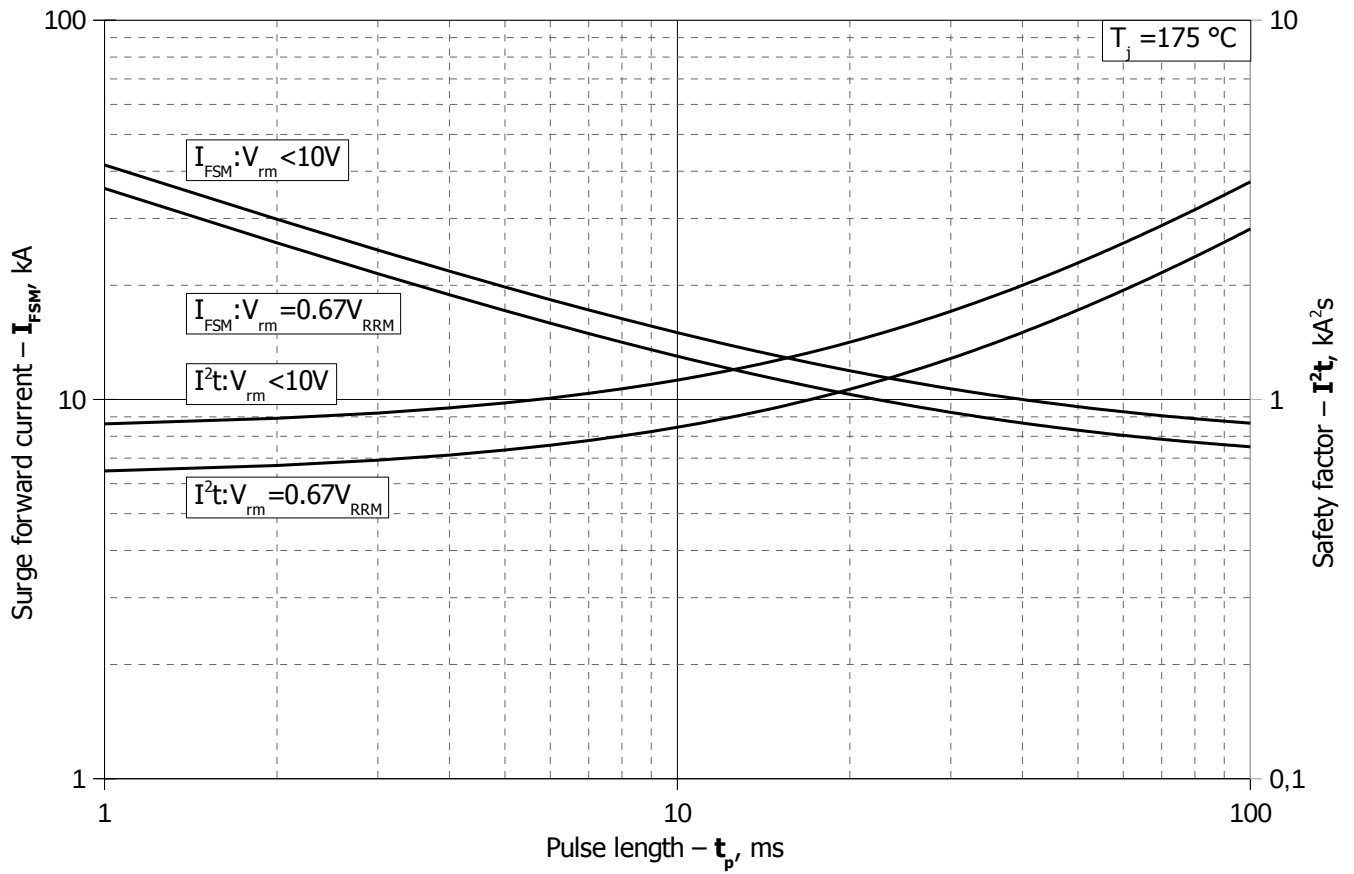


Fig. 11 – Maximum surge forward current I_{FSM} and safety factor I^2t vs. pulse length t_p

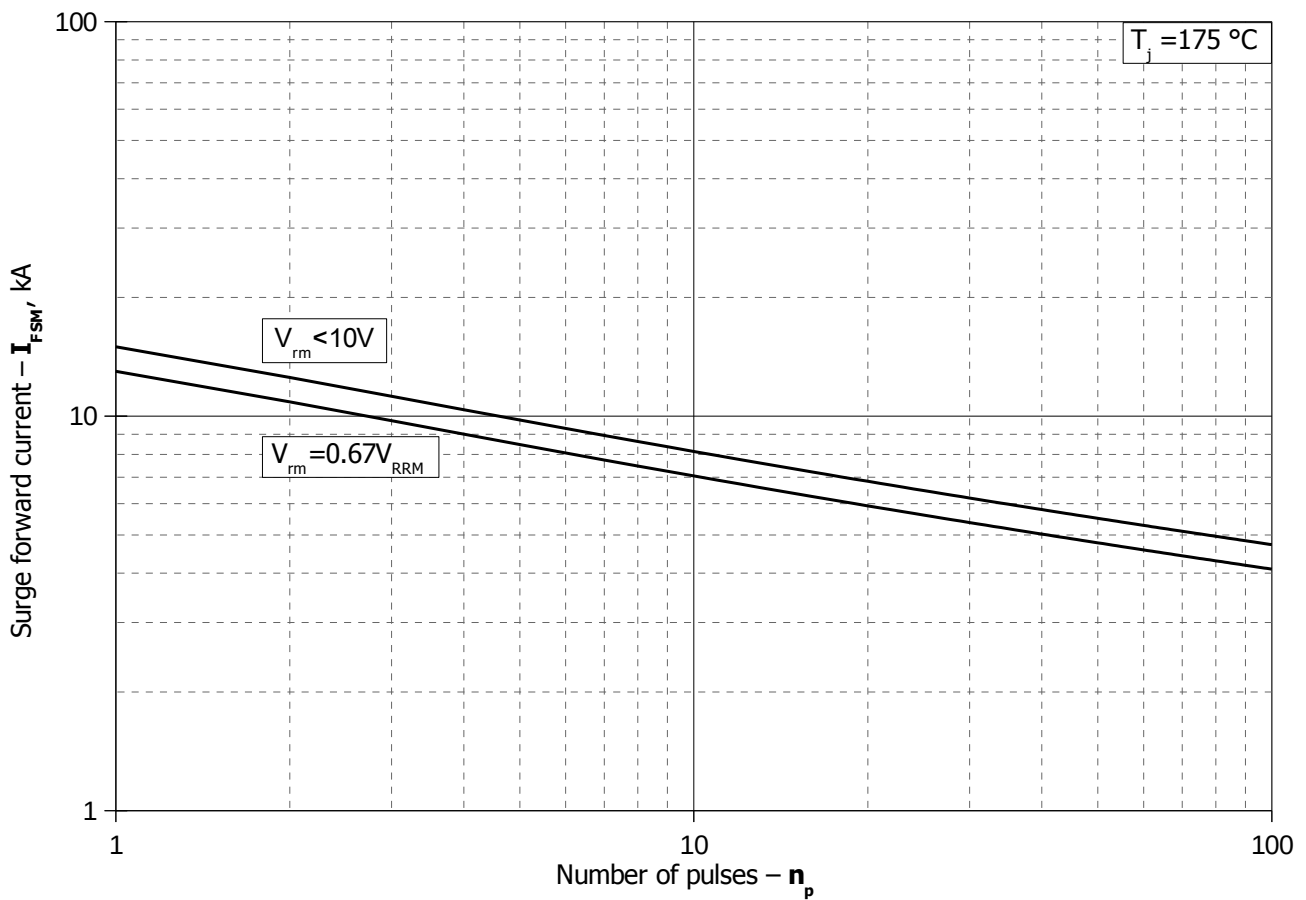


Fig. 12 - Maximum surge forward current I_{FSM} vs. number of pulses n_p