

Low switching losses
 Low reverse recovery charge
 High power cycling capability

Fast Recovery Diode Type DF453-800-44

| | | | | |
|---------------------------------|------------|-----------|---------------|------|
| Average forward current | | I_{FAV} | 800 A | |
| Repetitive peak reverse voltage | | V_{RRM} | 3800 ÷ 4400 V | |
| Reverse recovery time | | t_{rr} | 5.3 μ s | |
| V_{RRM} , V | 3800 | 4000 | 4200 | 4400 |
| Voltage code | 38 | 40 | 42 | 44 |
| T_j , °C | - 60 ÷ 125 | | | |

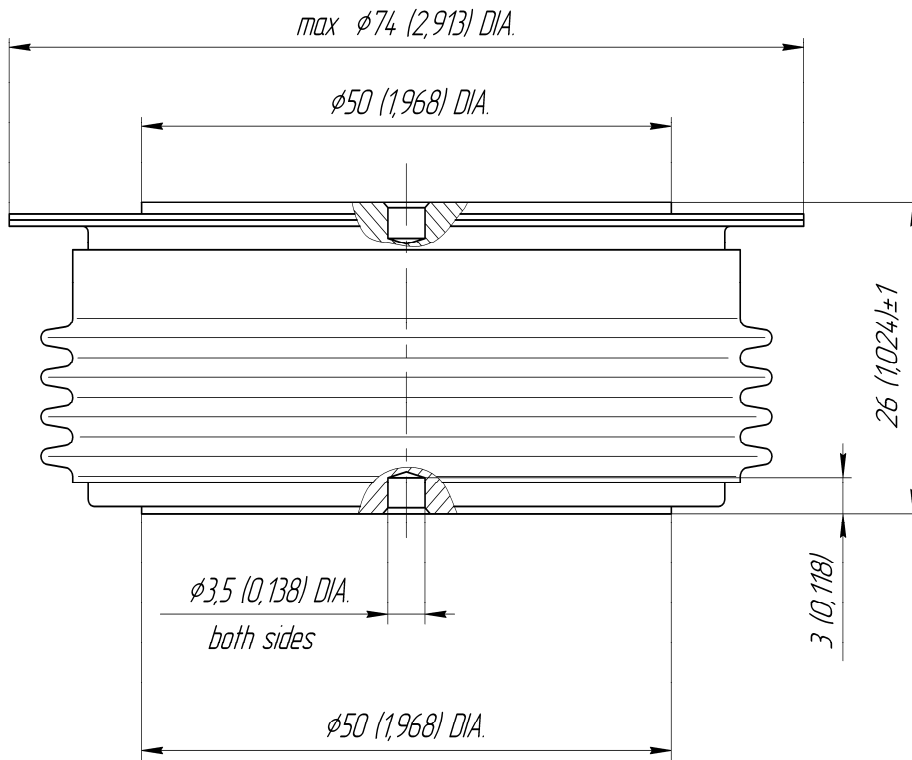
MAXIMUM ALLOWABLE RATINGS

| Symbols and parameters | | Units | Values | Test conditions | |
|------------------------|--------------------------------------|-------------------|----------------------|--|--|
| ON-STATE | | | | | |
| I_{FAV} | Average forward current | A | 800 1150 | $T_c=85$ °C; Double side cooled; $T_c=55$ °C; Double side cooled; 180° half-sine wave; 50 Hz | |
| I_{FRMS} | RMS forward current | A | 1256 | $T_c=85$ °C; Double side cooled; 180° half-sine wave; 50 Hz | |
| I_{FSM} | Surge forward current | kA | 13.5 16.0 | $T_j=T_{j\ max}$ $T_j=25$ °C | 180° half-sine wave; 50 Hz ($t_p=10$ ms); single pulse; $V_R=0$ V; |
| | | | 15.0 17.0 | $T_j=T_{j\ max}$ $T_j=25$ °C | 180° half-sine wave; 60 Hz ($t_p=8.3$ ms); single pulse; $V_R=0$ V; |
| I^2t | Safety factor | $A^2s \cdot 10^3$ | 910 1280 | $T_j=T_{j\ max}$ $T_j=25$ °C | 180° half-sine wave; 50 Hz ($t_p=10$ ms); single pulse; $V_R=0$ V; |
| | | | 930 1195 | $T_j=T_{j\ max}$ $T_j=25$ °C | 180° half-sine wave; 60 Hz ($t_p=8.3$ ms); single pulse; $V_R=0$ V; |
| BLOCKING | | | | | |
| V_{RRM} | Repetitive peak reverse voltages | V | 3800÷4400 | $T_{j\ min} < T_j < T_{j\ max}$; 180° half-sine wave; 50 Hz; | |
| V_{RSM} | Non-repetitive peak reverse voltages | V | 3900÷4500 | $T_{j\ min} < T_j < T_{j\ max}$; 180° half-sine wave; 50 Hz; single pulse; | |
| V_R | Reverse continuous voltages | V | $0.75 \cdot V_{RRM}$ | $T_j=T_{j\ max}$; | |
| THERMAL | | | | | |
| T_{stg} | Storage temperature | °C | - 60 ÷ 125 | | |
| T_j | Operating junction temperature | °C | - 60 ÷ 125 | | |
| MECHANICAL | | | | | |
| F | Mounting force | kN | 24.0 ÷ 28.0 | | |
| a | Acceleration | m/s^2 | 50 | Device unclamped | |
| | | | 100 | Device clamped | |

CHARACTERISTICS

| Symbols and parameters | | Units | Values | Conditions | |
|------------------------|---|---------------------------|------------------|--|---------------------|
| ON-STATE | | | | | |
| V_{FM} | Peak forward voltage, max | V | 2.90 | $T_j=25\text{ }^\circ\text{C}; I_{FM}=2512\text{ A}$ | |
| $V_{F(TO)}$ | Forward threshold voltage, max | V | 1.40 | $T_j=T_{j\text{ max}};$ $0.5 \pi I_{FAV} < I_T < 1.5 \pi I_{FAV}$ | |
| r_T | Forward slope resistance, max | m Ω | 0.700 | | |
| BLOCKING | | | | | |
| I_{RRM} | Repetitive peak reverse current, max | mA | 120 | $T_j=T_{j\text{ max}};$ $V_R=V_{RRM}$ | |
| SWITCHING | | | | | |
| Q_{rr} | Total recovered charge, max | μC | 880 | $T_j=T_{j\text{ max}}; I_{FM}=I_{FAV};$ $di_R/dt=-100\text{ A}/\mu\text{s};$ $V_R=100\text{ V};$ | |
| t_{rr} | Reverse recovery time, max | μs | 5.3 | | |
| I_{rrM} | Peak reverse recovery current, typ | A | 332 | | |
| THERMAL | | | | | |
| R_{thjc} | Thermal resistance, junction to case, max | $^\circ\text{C}/\text{W}$ | 0.0180 | Direct current | Double side cooled |
| R_{thjc-A} | | | 0.0396 | | Anode side cooled |
| R_{thjc-K} | | | 0.0324 | | Cathode side cooled |
| R_{thck} | Thermal resistance, case to heatsink, max | $^\circ\text{C}/\text{W}$ | 0.0040 | Direct current | |
| MECHANICAL | | | | | |
| w | Weight, typ | g | 510 | | |
| D_s | Surface creepage distance | mm (inch) | 38.84 (1.529) | | |
| D_a | Air strike distance | mm (inch) | 22.50 (0.886) | | |

| PART NUMBERING GUIDE | | | | | | GROUP OF RECOVERY TIME | |
|---|-----|-----|----|----|---|-------------------------------|--|
| DF | 453 | 800 | 44 | C4 | N | Group Symbol | |
| 1 | 2 | 3 | 4 | 5 | 6 | $t_{rr}, \mu\text{s}$ | |
| 1. Fast recovery diode 2. Design version 3. Average forward current, A 4. Voltage code 5. Group of reverse recovery time 6. Ambient conditions: N – normal; T – tropical | | | | | | C4 | |
| | | | | | | 6.3 | |



All dimensions in millimeters (inches)

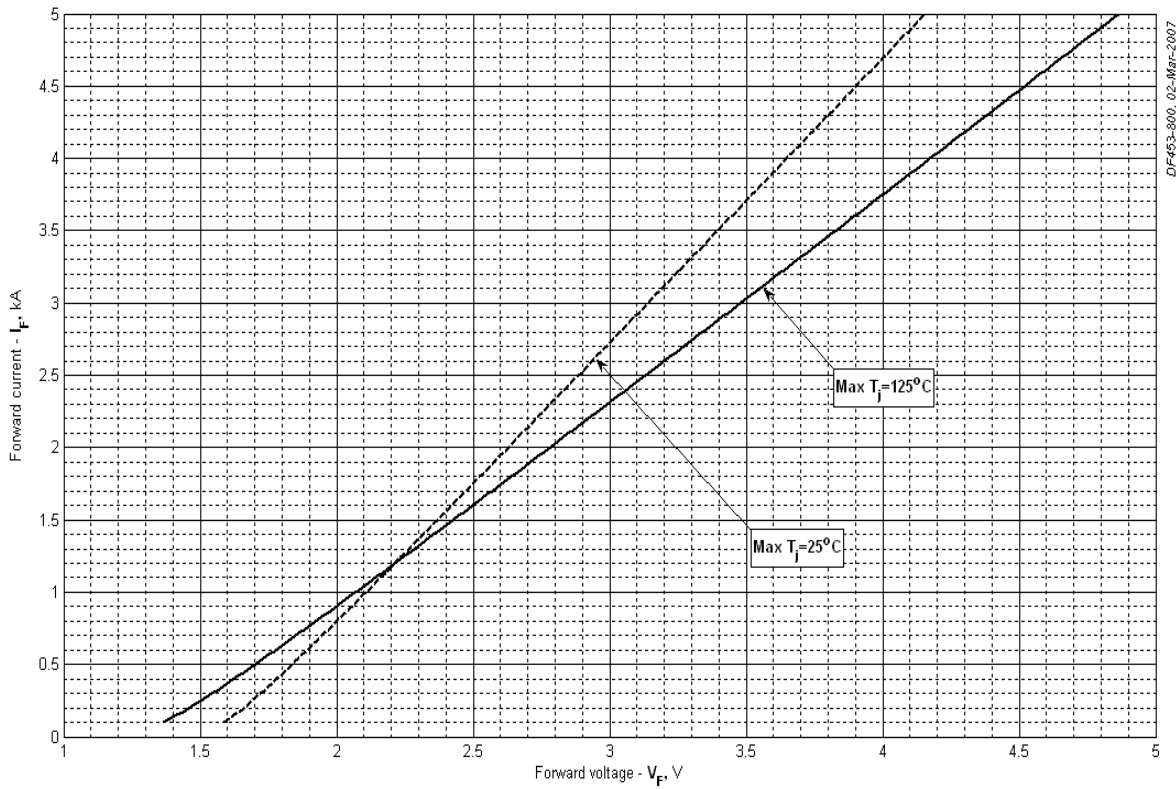


Fig 1 – Forward characteristics of Limit device

Analytical function for Forward characteristic:

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

| | Coefficients for max curves | |
|----------|-----------------------------|-------------------------|
| | $T_j = 25^\circ\text{C}$ | $T_j = T_{j\text{max}}$ |
| A | 1.469142 | 1.202344 |
| B | 0.469424 | 0.642163 |
| C | -0.158239 | -0.211339 |
| D | 0.278291 | 0.371677 |

Forward characteristic model (see Fig. 1).

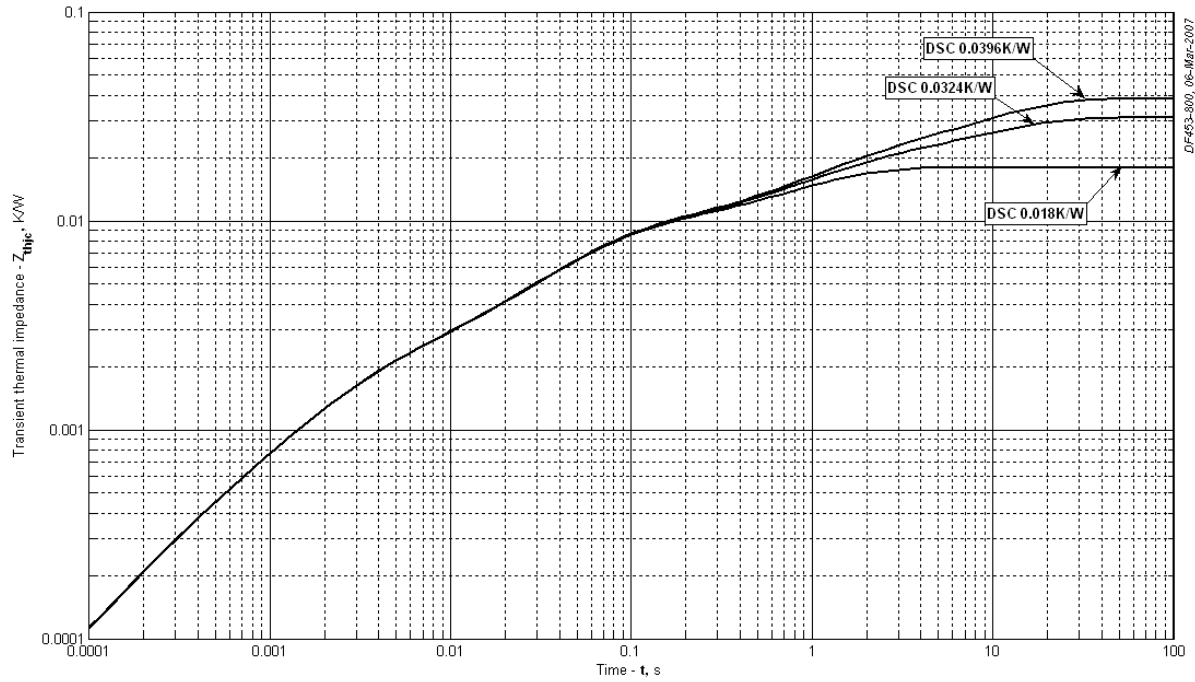


Fig 2 – Transient thermal impedance

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 | 0.009241 | 0.006037 | 0.001231 | 0.001054 | 0.0003396 | 0.00009575 |
| τ_i s | 0.9673 | 0.04967 | 0.002733 | 0.07734 | 0.001638 | 0.0002248 |

DC Cathode side cooled

| i | 1 | 2 | 3 | 4 | 5 | 6 |
|------------|---------|----------|----------|----------|----------|-----------|
| R_i K/W | 0.01318 | 0.009281 | 0.006055 | 0.001018 | 0.001535 | 0.0001182 |
| τ_i s | 9.745 | 1.028 | 0.05591 | 0.03732 | 0.002468 | 0.0002687 |

DC Anode side cooled

| i | 1 | 2 | 3 | 4 | 5 | 6 |
|------------|---------|----------|----------|-----------|----------|-----------|
| R_i K/W | 0.02041 | 0.009325 | 0.006949 | 0.0001252 | 0.001516 | 0.0001119 |
| τ_i s | 9.752 | 1.065 | 0.05344 | 0.01407 | 0.002421 | 0.0002554 |

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

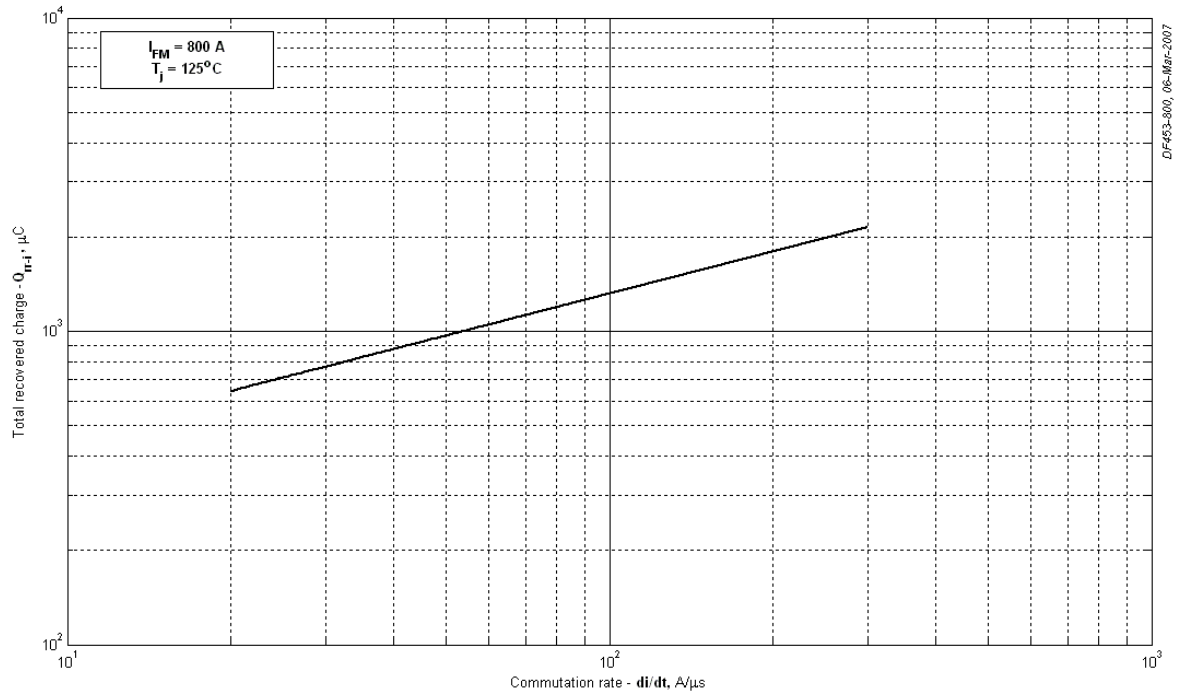


Fig 3 - Total recovered charge(integral), Q_{rr}

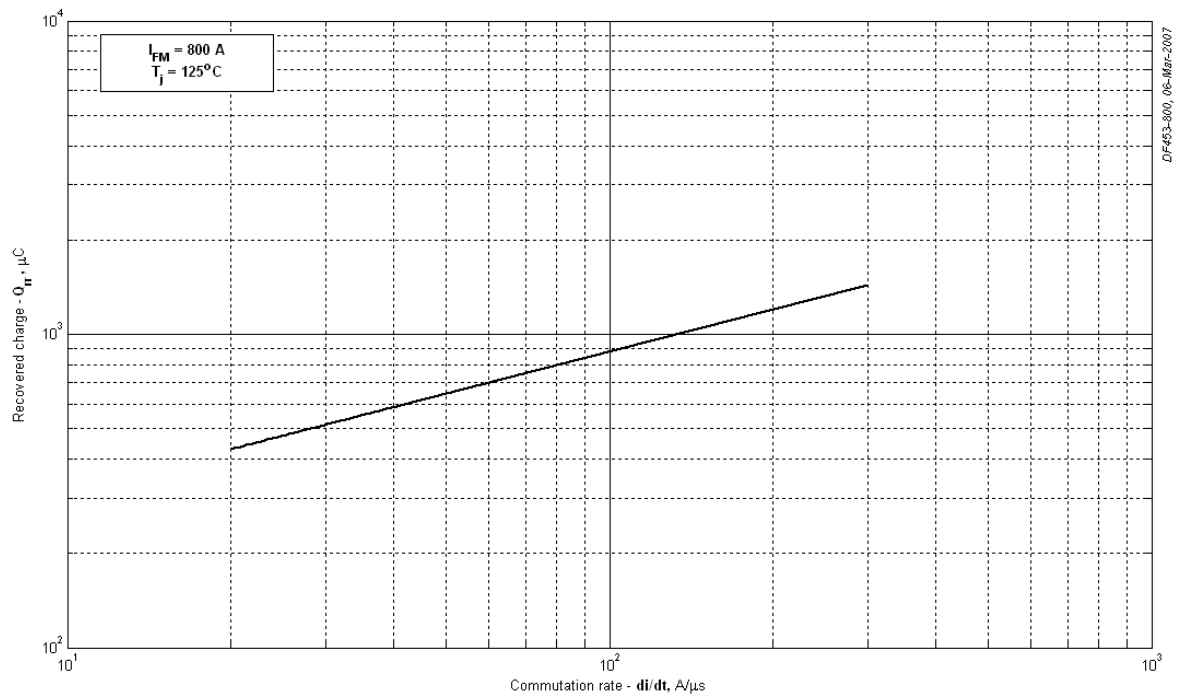


Fig 4 - Total recovered charge, Q_{rr}

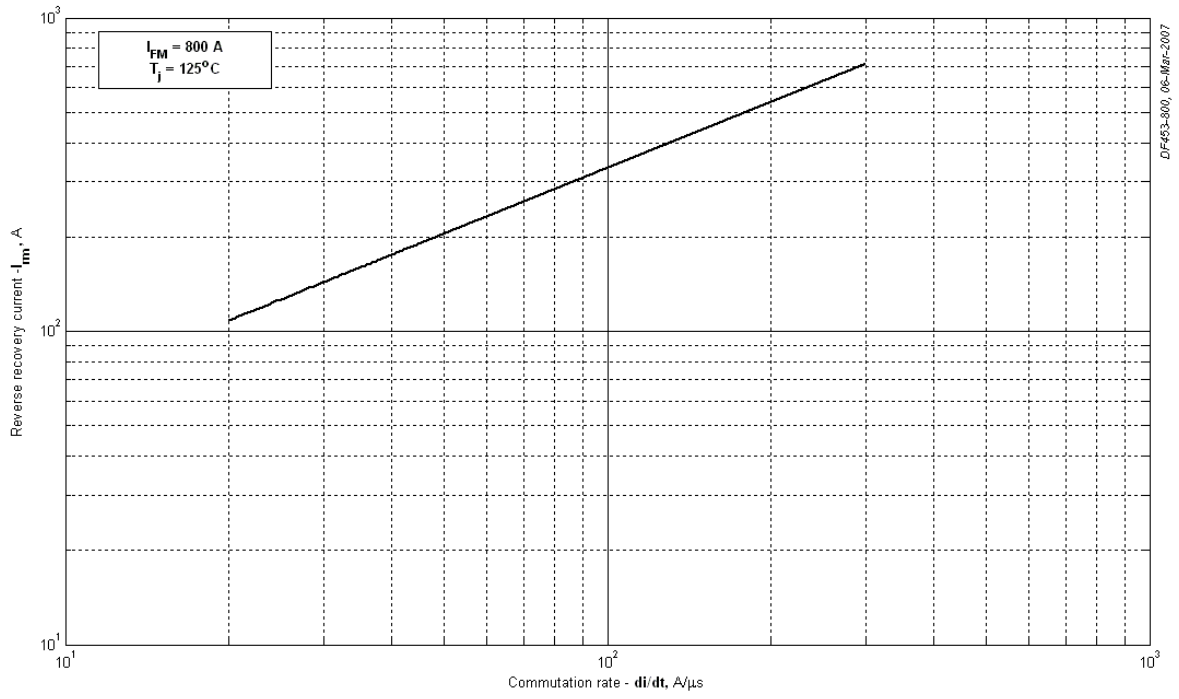


Fig 5 - Peak reverse recovery current, I_{fm}

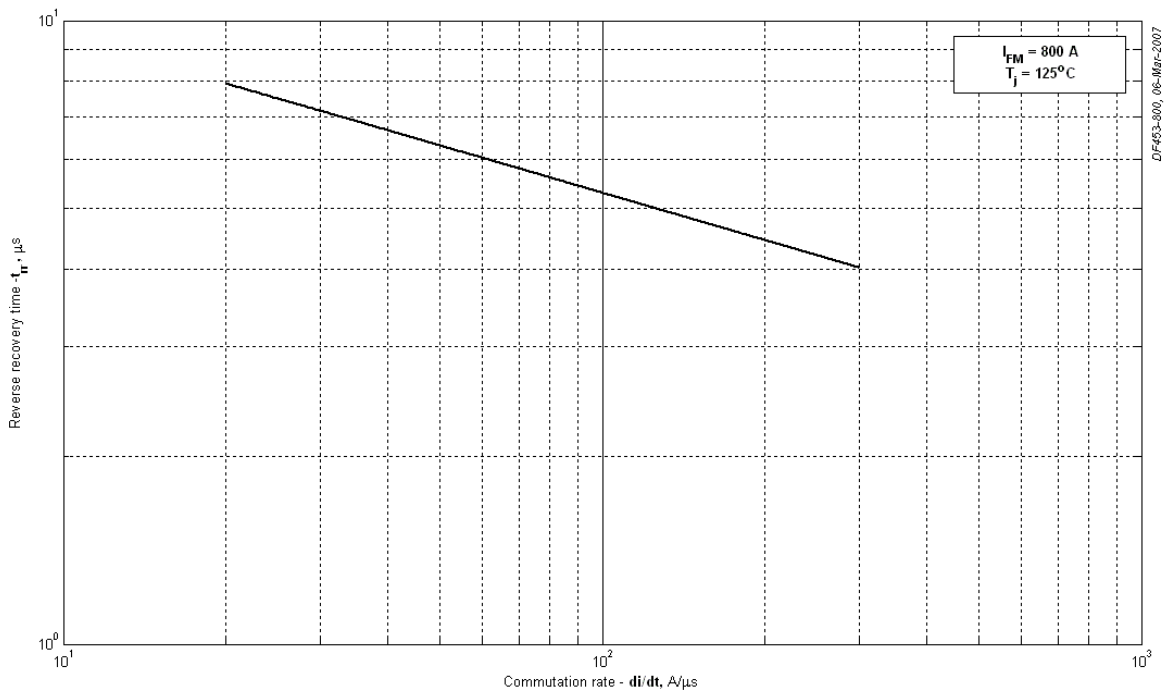
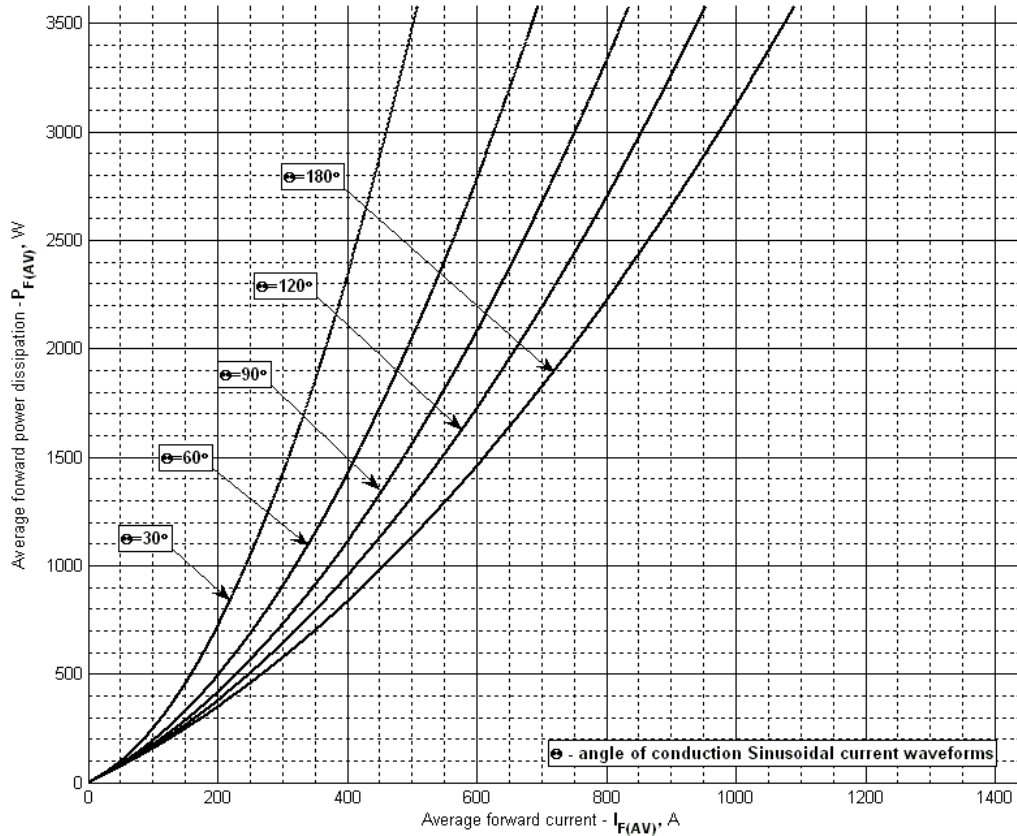
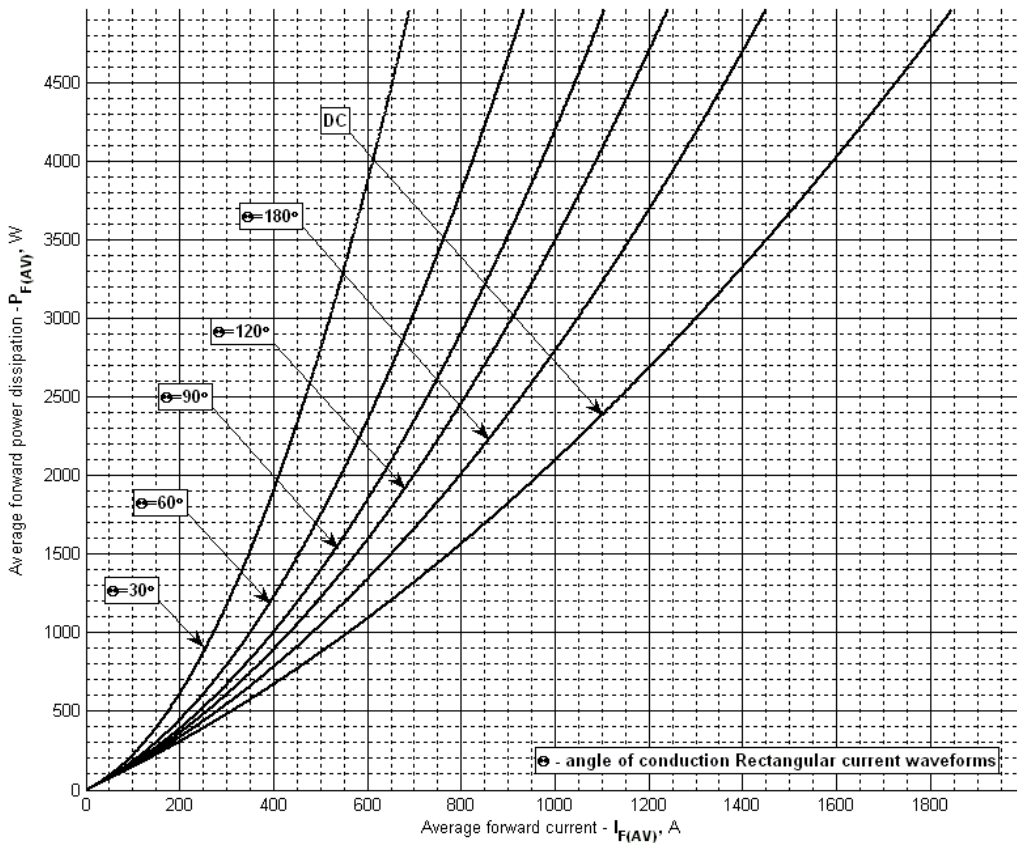


Fig 6 - Recovery time, t_{tr} (50% chord)



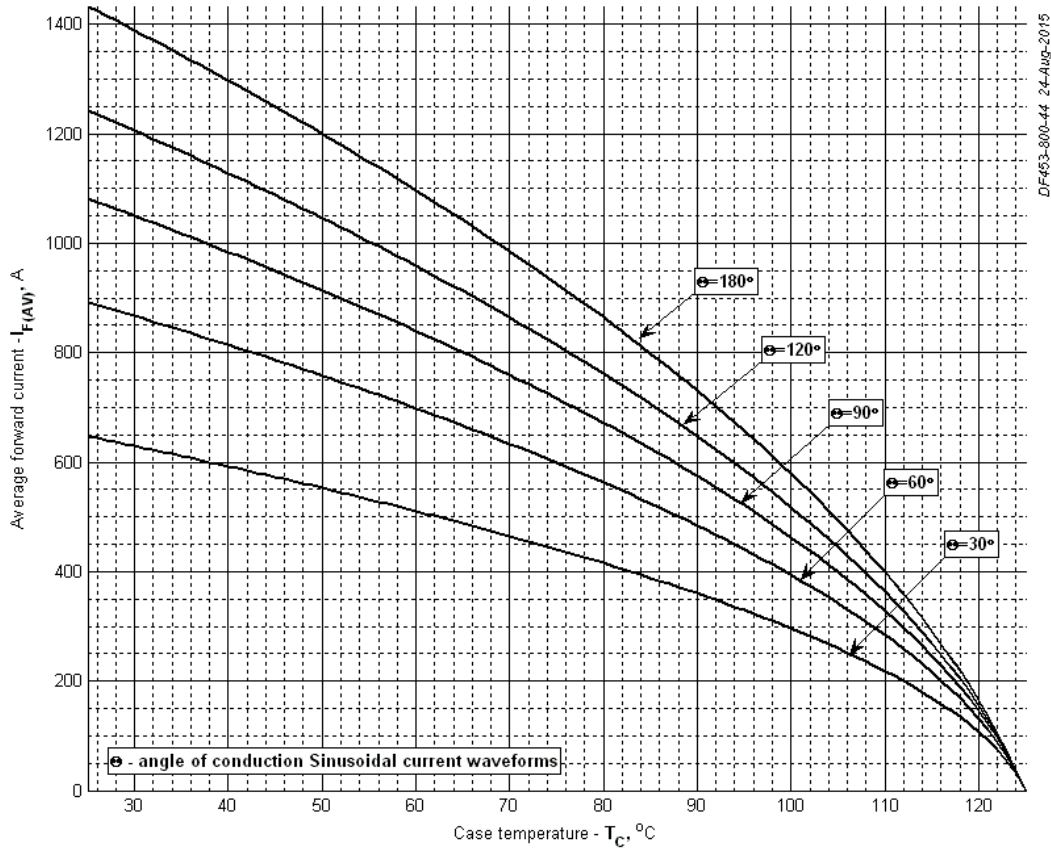
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Fig 7 - Mean forward power dissipation P_{FAV} vs. Mean forward current I_{FAV} for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$, DSC)



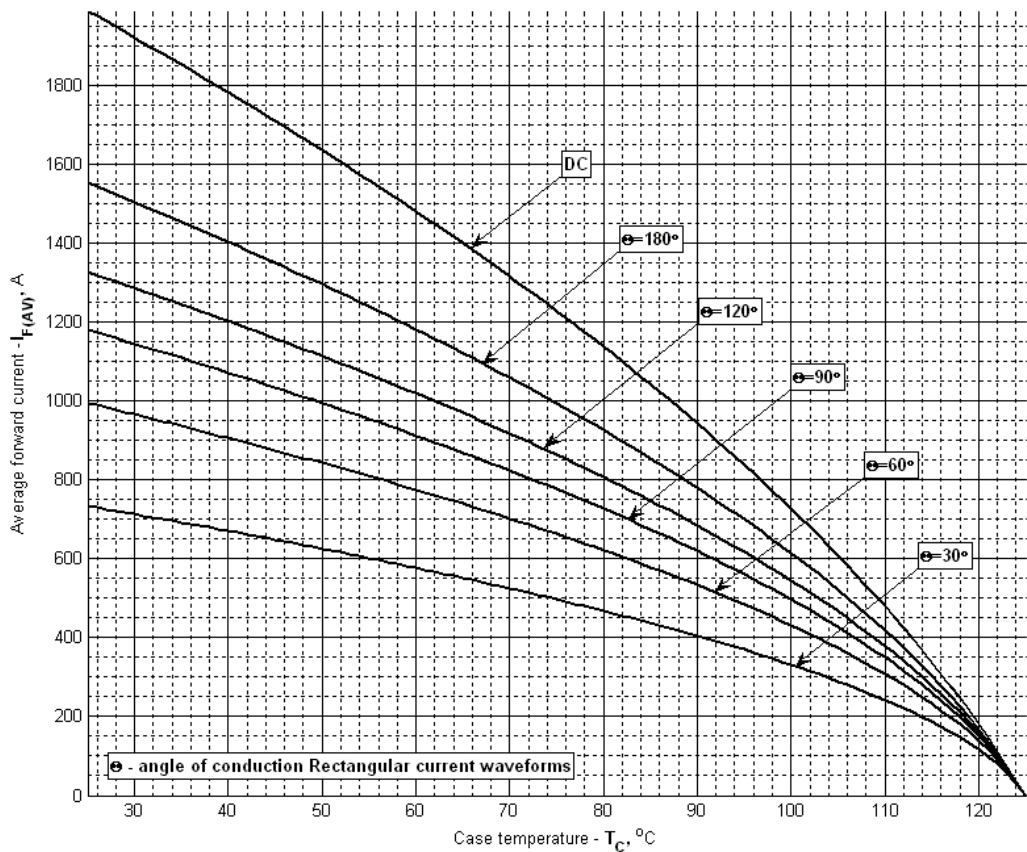
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Fig 8 – Mean forward power dissipation P_{FAV} vs. Mean forward current I_{FAV} for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)



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Fig 9 – Mean forward current I_{FAV} vs. Case temperature T_C for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$, DSC)



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Fig 10 - Mean forward current I_{FAV} vs. Case temperature T_C for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)