



High power cycling capability  
 Low on-state and switching losses  
 Optimized for line frequency rectifiers  
 Designed for traction and industrial applications

**Rectifier Diode  
 Type D173-5000-20**

|                                 |           |           |
|---------------------------------|-----------|-----------|
| Average forward current         | $I_{FAV}$ | 5000 A    |
| Repetitive peak reverse voltage | $V_{RRM}$ | 2000 V    |
| $V_{RRM}, V$                    |           | 2000      |
| Voltage code                    |           | 20        |
| $T_j, ^\circ C$                 |           | -60 ÷ 175 |

**MAXIMUM ALLOWABLE RATINGS**

| Symbols and parameters |                                      | Units             | Values               | Test conditions  |
|------------------------|--------------------------------------|-------------------|----------------------|--|
| <b>ON-STATE</b>        |                                      |                   |                      |  |
| $I_{FAV}$              | Average forward current              | A                 | 5000<br>5450         | $T_c=109\ ^\circ C$ ; Double side cooled;<br>$T_c=100\ ^\circ C$ ; Double side cooled;<br>180° half-sine wave; 50 Hz     |
| $I_{FRMS}$             | RMS forward current                  | A                 | 7850                 | $T_c=109\ ^\circ C$ ; Double side cooled;<br>180° half-sine wave; 50 Hz  |
| $I_{FSM}$              | Surge forward current                | kA                | 60.0<br>69.0         | $T_j=T_{j\ max}$<br>$T_j=25\ ^\circ C$<br>180° half-sine wave; 50 Hz<br>( $t_p=10\ ms$ ); single pulse;<br>$V_R=0\ V$ ;  |
|                        |                                      |                   | 63.0<br>72.0         | $T_j=T_{j\ max}$<br>$T_j=25\ ^\circ C$<br>180° half-sine wave; 60 Hz<br>( $t_p=8.3\ ms$ ); single pulse;<br>$V_R=0\ V$ ; |
| $I^2t$                 | Safety factor                        | $A^2s \cdot 10^3$ | 18000<br>23805       | $T_j=T_{j\ max}$<br>$T_j=25\ ^\circ C$<br>180° half-sine wave; 50 Hz<br>( $t_p=10\ ms$ ); single pulse;<br>$V_R=0\ V$ ;  |
|                        |                                      |                   | 16470<br>21510       | $T_j=T_{j\ max}$<br>$T_j=25\ ^\circ C$<br>180° half-sine wave; 60 Hz<br>( $t_p=8.3\ ms$ ); single pulse;<br>$V_R=0\ V$ ; |
| <b>BLOCKING</b>        |                                      |                   |                      |  |
| $V_{RRM}$              | Repetitive peak reverse voltages     | V                 | 2000                 | $T_{j\ min} < T_j < T_{j\ max}$ ;<br>180° half-sine wave; 50 Hz;   |
| $V_{RSM}$              | Non-repetitive peak reverse voltages | V                 | 2100                 | $T_{j\ min} < T_j < T_{j\ max}$ ;<br>180° half-sine wave; 50 Hz; single pulse;   |
| $V_R$                  | Reverse continuous voltages          | V                 | $0.75 \cdot V_{RRM}$ | $T_j = T_{j\ max}$ ;   |
| <b>THERMAL</b>         |                                      |                   |                      |  |
| $T_{stg}$              | Storage temperature                  | $^\circ C$        | -60 ÷ 50             |  |
| $T_j$                  | Operating junction temperature       | $^\circ C$        | -60 ÷ 175            |  |
| <b>MECHANICAL</b>      |                                      |                   |                      |  |
| F                      | Mounting force                       | kN                | 40 ÷ 50              |  |
| a                      | Acceleration                         | $m/s^2$           | 50                   | Device unclamped   |
|                        |                                      |                   | 100                  | Device clamped   |

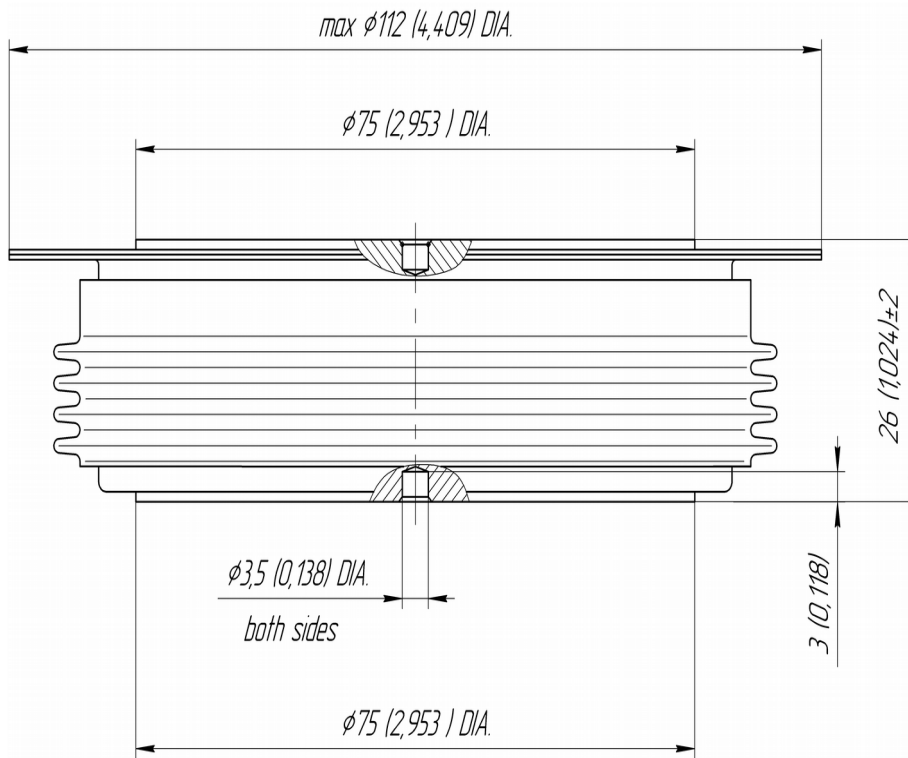
## CHARACTERISTICS

| Symbols and parameters |   | Units                     | Values           | Conditions  |                     |
|------------------------|---|---------------------------|------------------|---|---------------------|
| <b>ON-STATE</b>        |   |                           |                  |   |                     |
| $V_{FM}$               | Peak forward voltage, max                 | V                         | 1.65             | $T_j=25\text{ }^\circ\text{C}; I_{FM}=12560\text{ A}$ |                     |
| $V_{F(TO)}$            | Forward threshold voltage, max            | V                         | 0.75             | $T_j=T_{j\text{max}};$                                |                     |
| $r_T$                  | Forward slope resistance, max             | m $\Omega$                | 0.065            | $0.5\pi I_{FAV} < I_T < 1.5\pi I_{FAV}$               |                     |
| <b>BLOCKING</b>        |   |                           |                  |   |                     |
| $I_{RRM}$              | Repetitive peak reverse current, max      | mA                        | 150              | $T_j=T_{j\text{max}};$<br>$V_R=V_{RRM}$               |                     |
| <b>SWITCHING</b>       |   |                           |                  |   |                     |
| $Q_{rr}$               | Total recovered charge, max               | $\mu\text{C}$             | 4370             | $T_j=T_{j\text{max}}; I_{FM}=2000\text{ A};$          |                     |
| $t_{rr}$               | Reverse recovery time, max                | $\mu\text{s}$             | 35               | $di_R/dt=-10\text{ A}/\mu\text{s};$                   |                     |
| $I_{rrM}$              | Peak reverse recovery current, max        | A                         | 250              | $V_R=100\text{ V}$                                    |                     |
| <b>THERMAL</b>         |   |                           |                  |   |                     |
| $R_{thjc}$             | Thermal resistance, junction to case, max | $^\circ\text{C}/\text{W}$ | 0.0085           | Direct current  | Double side cooled  |
| $R_{thjc-A}$           |   |                           | 0.0187           |   | Anode side cooled   |
| $R_{thjc-K}$           |   |                           | 0.0153           |   | Cathode side cooled |
| $R_{thck}$             | Thermal resistance, case to heatsink, max | $^\circ\text{C}/\text{W}$ | 0.0020           | Direct current  |                     |
| <b>MECHANICAL</b>      |   |                           |                  |   |                     |
| w                      | Weight, typ                               | g                         | 1500             |   |                     |
| $D_s$                  | Surface creepage distance                 | mm<br>(inch)              | 41.40<br>(1.630) |   |                     |
| $D_a$                  | Air strike distance                       | mm<br>(inch)              | 23.10<br>(0.909) |   |                     |

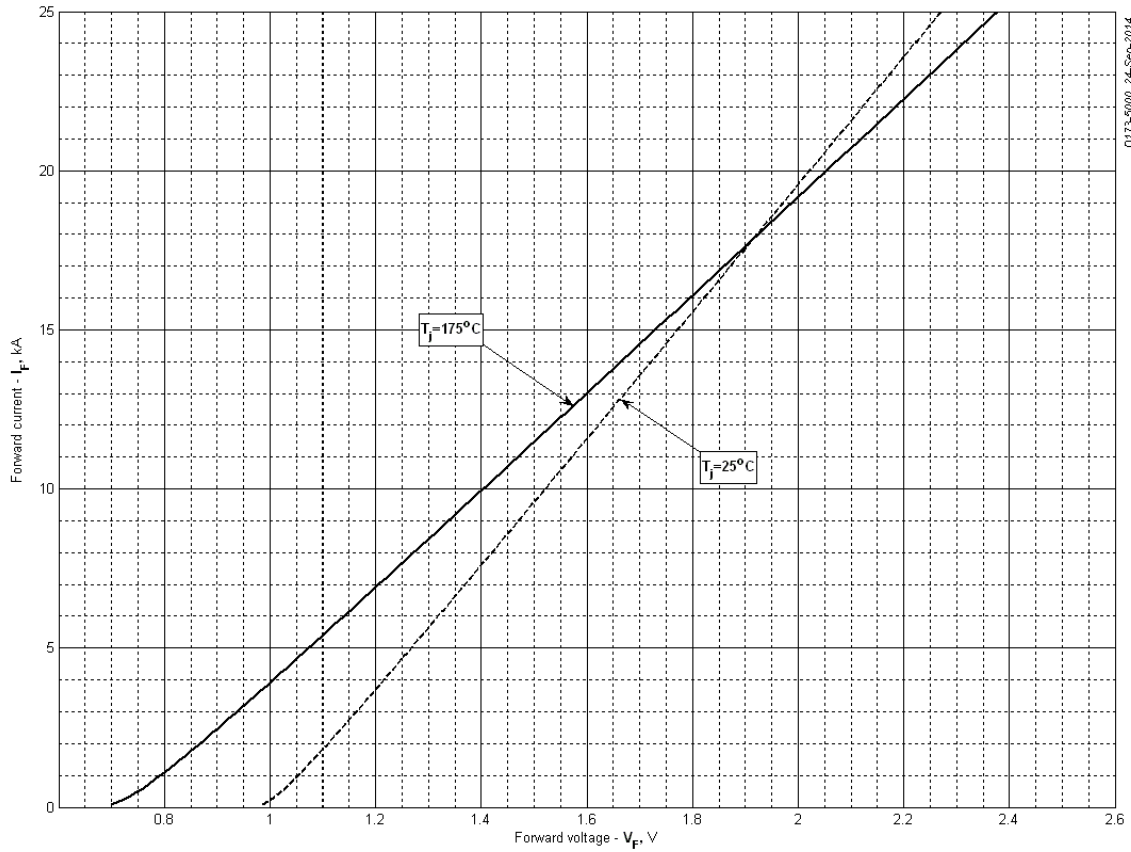
### PART NUMBERING GUIDE

|   |     |      |    |   |
|---|-----|------|----|---|
| D | 173 | 5000 | 20 | N |
| 1 | 2   | 3    | 4  | 5 |

1. D — Rectifier Diode
2. Design version
3. Average forward current, A
4. Voltage code
5. Ambient conditions: N – normal; T – tropical



All dimensions in millimeters (inches)



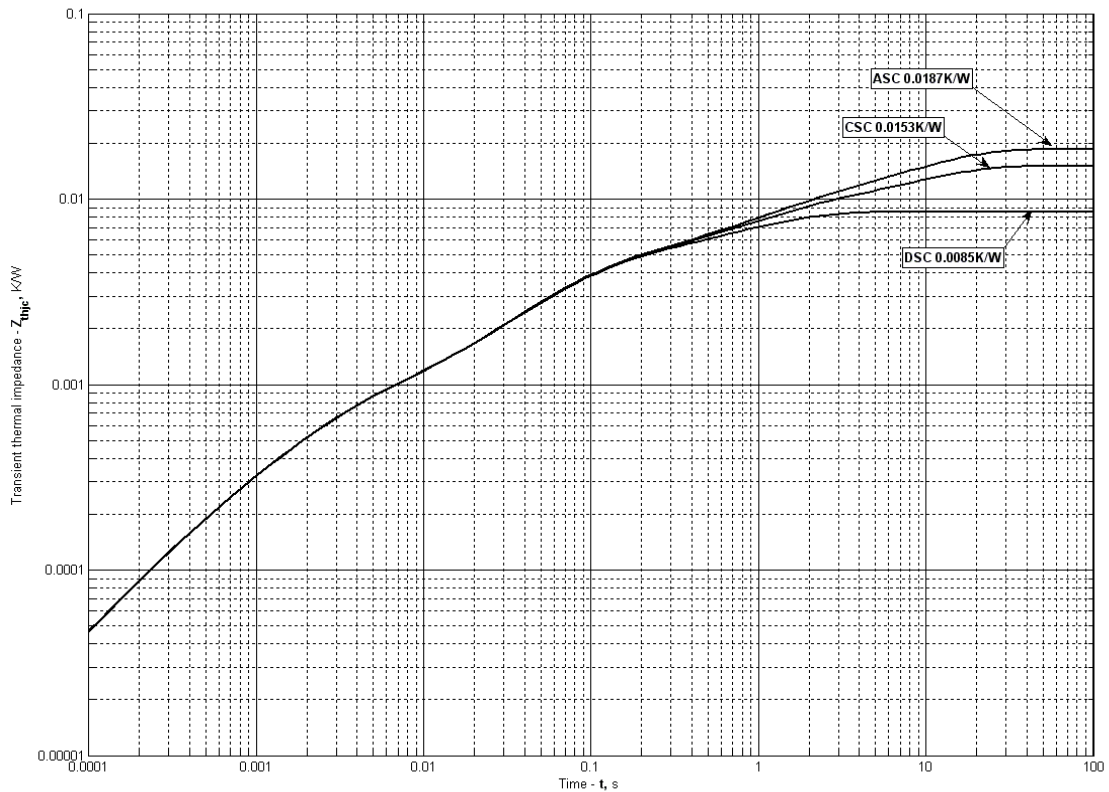
**Fig 1 – Forward characteristics of Limit device**

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 |                         |
|----------|-----------------------------|-------------------------|
|          | $T_j = 25^\circ\text{C}$    | $T_j = T_{j\text{max}}$ |
| <b>A</b> | 0.991905                    | 0.710549                |
| <b>B</b> | 0.049060                    | 0.063519                |
| <b>C</b> | 0.019009                    | 0.028578                |
| <b>D</b> | -0.002115                   | -0.003179               |

**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.

$\tau_i$  = Time constant of  $r_{th}$  term.

### DC Double side cooled

| <b>i</b>                      | <b>1</b>   | <b>2</b> | <b>3</b>  | <b>4</b> | <b>5</b>   | <b>6</b> |
|-------------------------------|------------|----------|-----------|----------|------------|----------|
| <b><math>R_i</math>, K/W</b>  | 0.00007989 | 0.002973 | 0.0005936 | 0.000846 | 0.00005975 | 0.003948 |
| <b><math>\tau_i</math>, S</b> | 1.688      | 0.06219  | 0.002329  | 0.138    | 0.0003243  | 0.9533   |

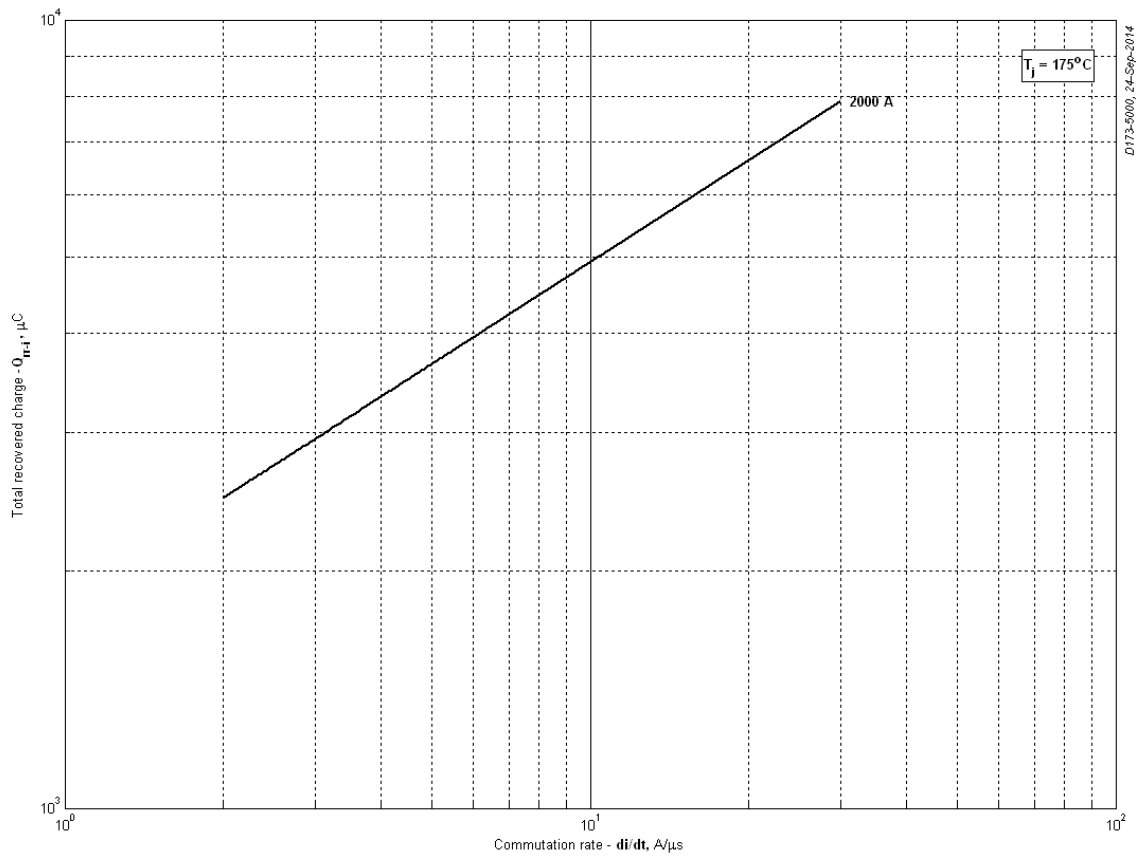
### DC Cathode side cooled

| <b>i</b>                      | <b>1</b> | <b>2</b> | <b>3</b>  | <b>4</b> | <b>5</b>  | <b>6</b>   |
|-------------------------------|----------|----------|-----------|----------|-----------|------------|
| <b><math>R_i</math>, K/W</b>  | 0.006619 | 0.004034 | 0.0008595 | 0.002956 | 0.0005965 | 0.00005689 |
| <b><math>\tau_i</math>, S</b> | 9.744    | 1.025    | 0.1394    | 0.06237  | 0.002318  | 0.0003037  |

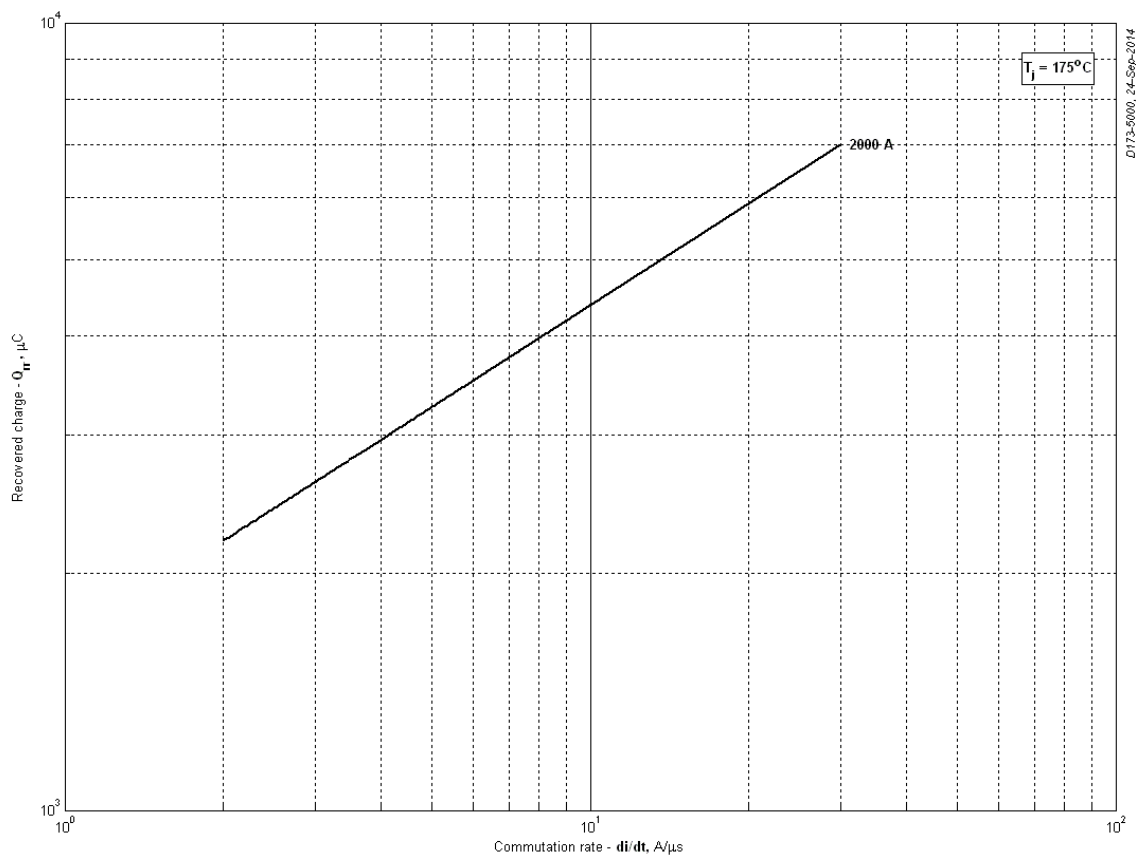
### DC Anode side cooled

| <b>i</b>                      | <b>1</b> | <b>2</b> | <b>3</b>  | <b>4</b> | <b>5</b>  | <b>6</b>   |
|-------------------------------|----------|----------|-----------|----------|-----------|------------|
| <b><math>R_i</math>, K/W</b>  | 0.01013  | 0.004062 | 0.0009401 | 0.002853 | 0.0005963 | 0.00005641 |
| <b><math>\tau_i</math>, S</b> | 9.747    | 1.058    | 0.1304    | 0.06179  | 0.002313  | 0.0003013  |

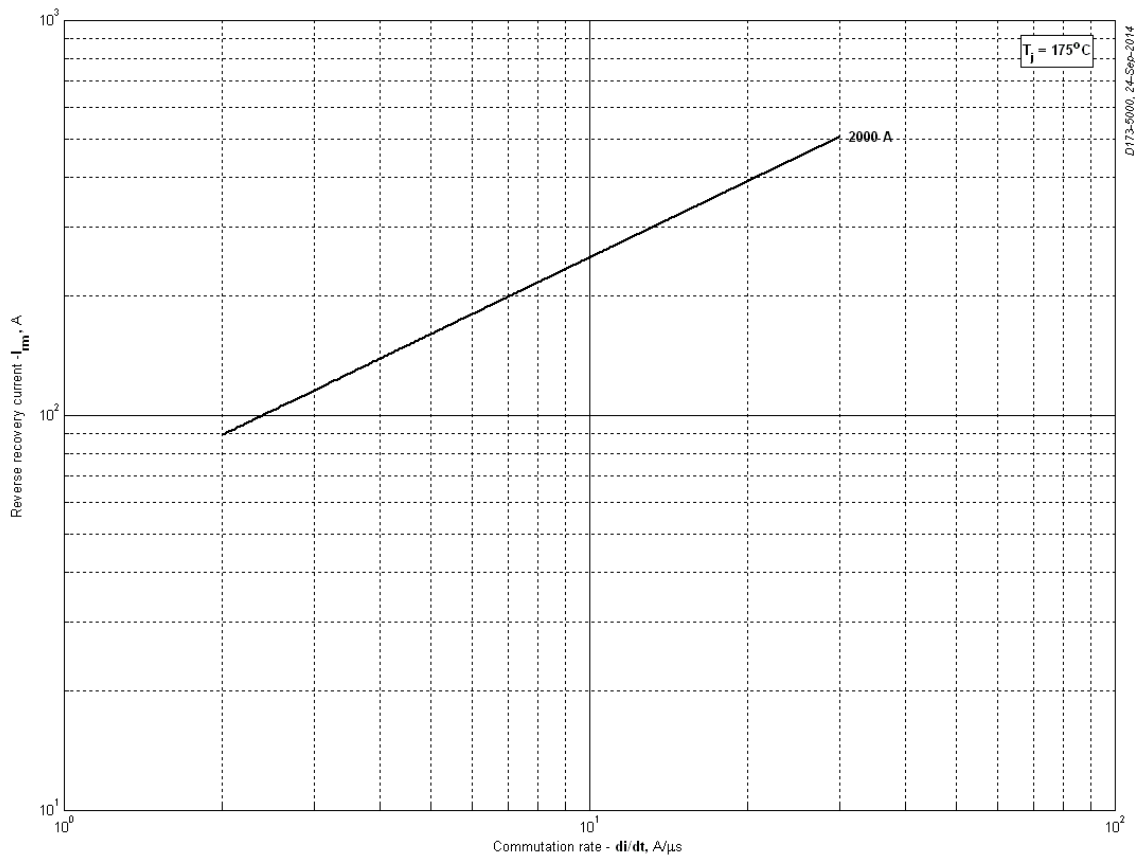
**Transient thermal impedance junction to case  $Z_{thjc}$  model (see Fig. 2)**



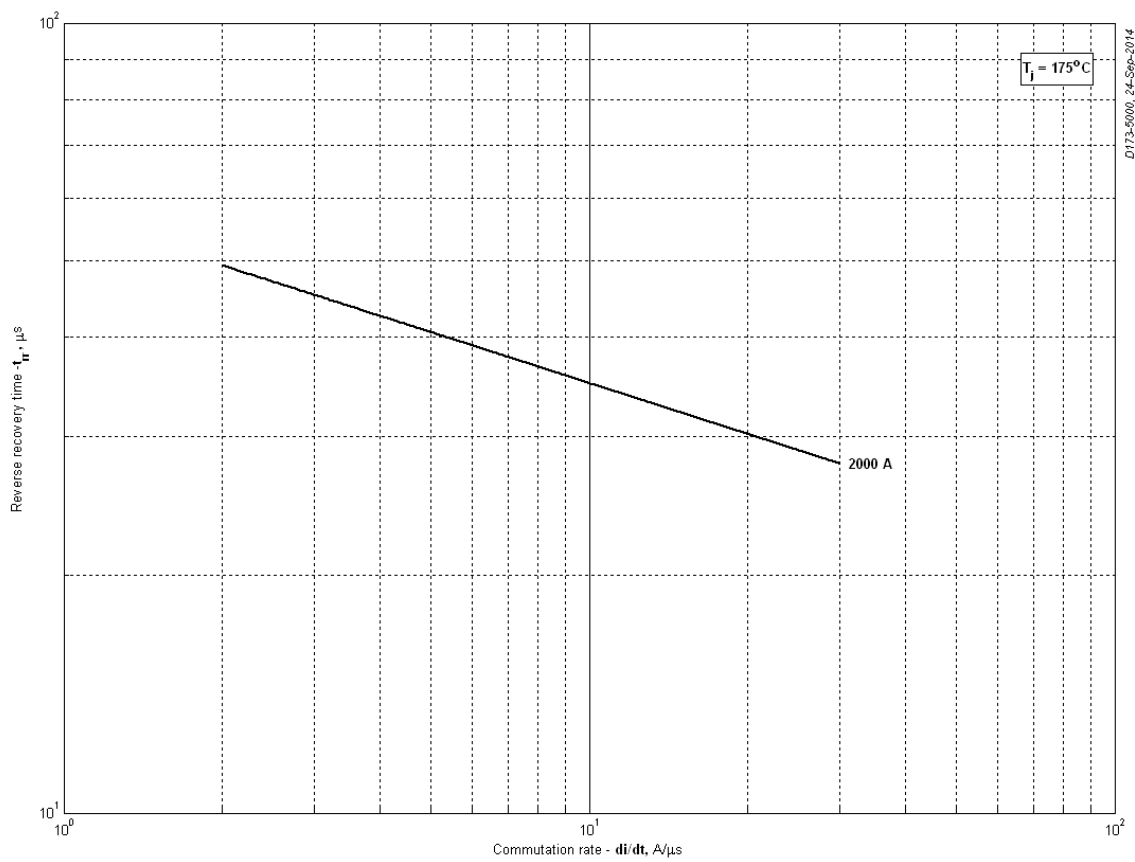
**Fig 3 - Total recovered charge(integral),  $Q_{rr-i}$**



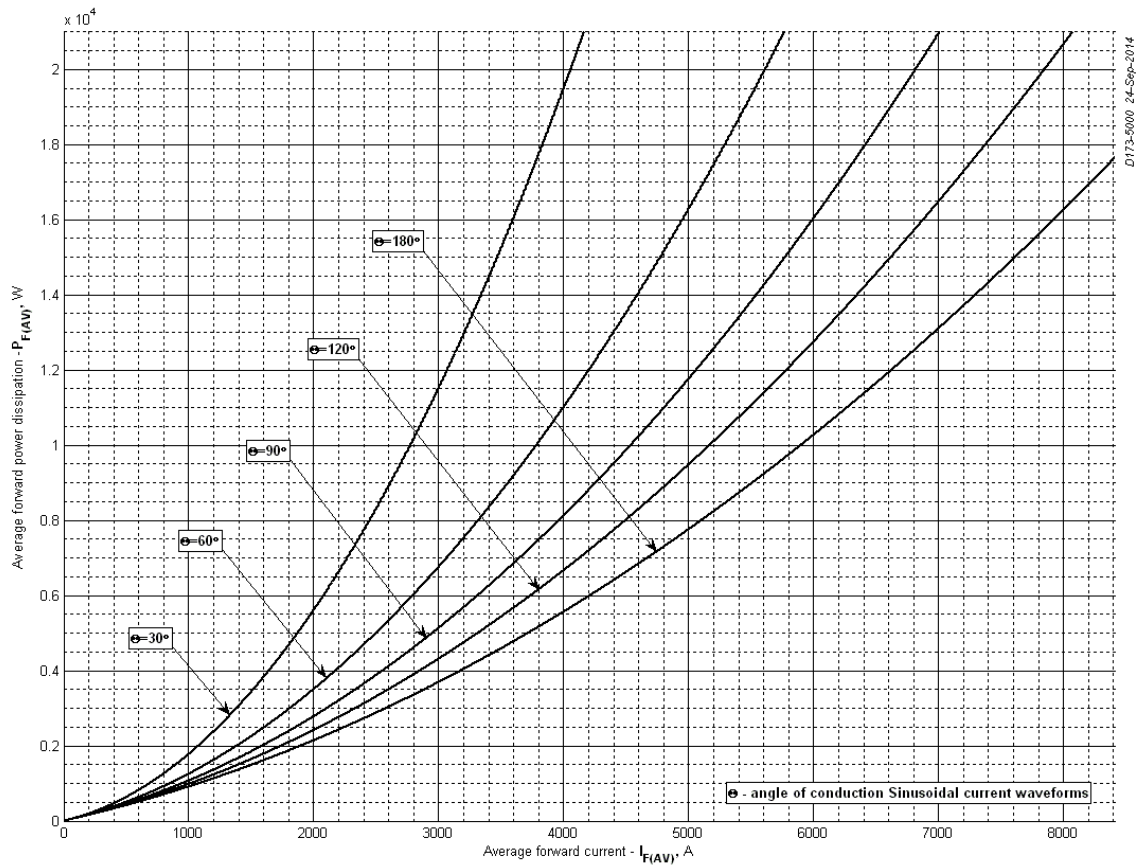
**Fig 4 - Total recovered charge(50% chord),  $Q_{rr}$**



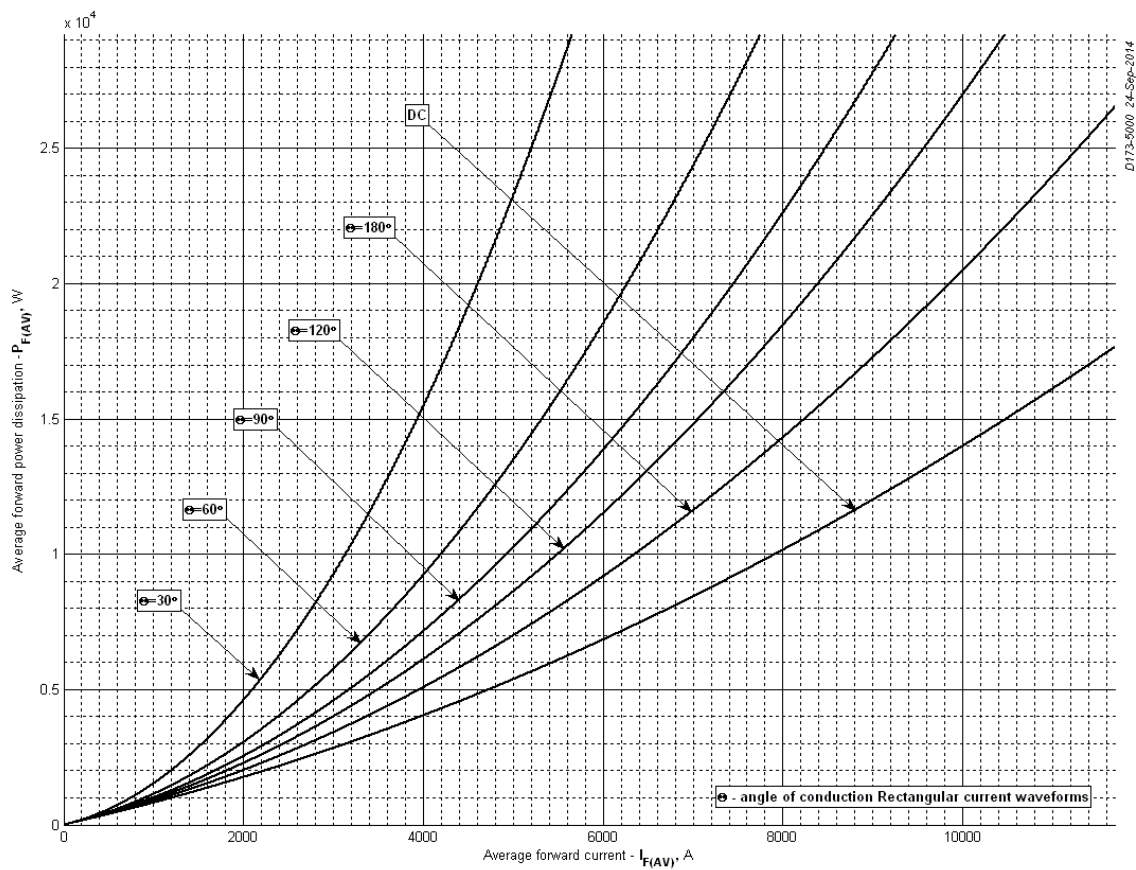
**Fig 5 - Peak reverse recovery current,  $I_{rm}$**



**Fig 6 - Recovery time,  $t_{rr}$  (50% chord)**

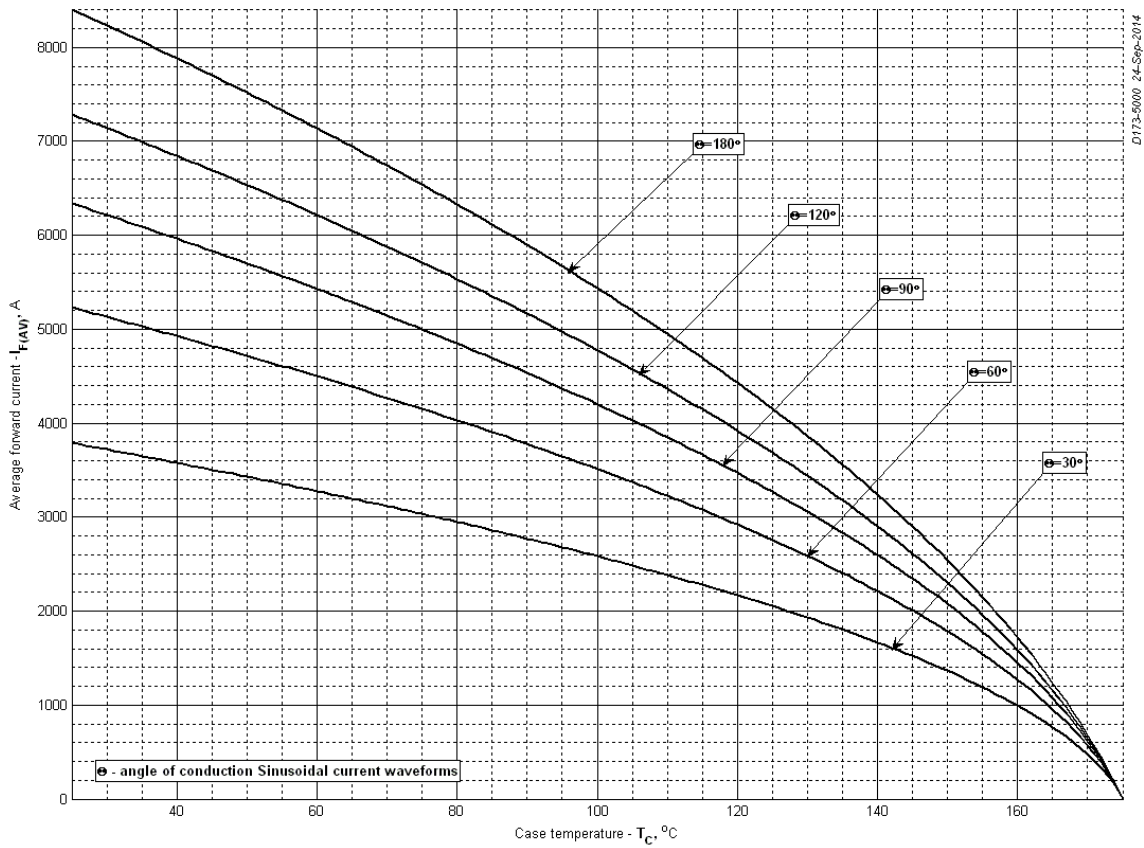


**Fig 7 - Mean forward power dissipation  $P_{FAV}$  vs. Mean forward current  $I_{FAV}$  for sinusoidal current waveforms at different conduction angles ( $f=50\text{Hz}$ , DSC)**



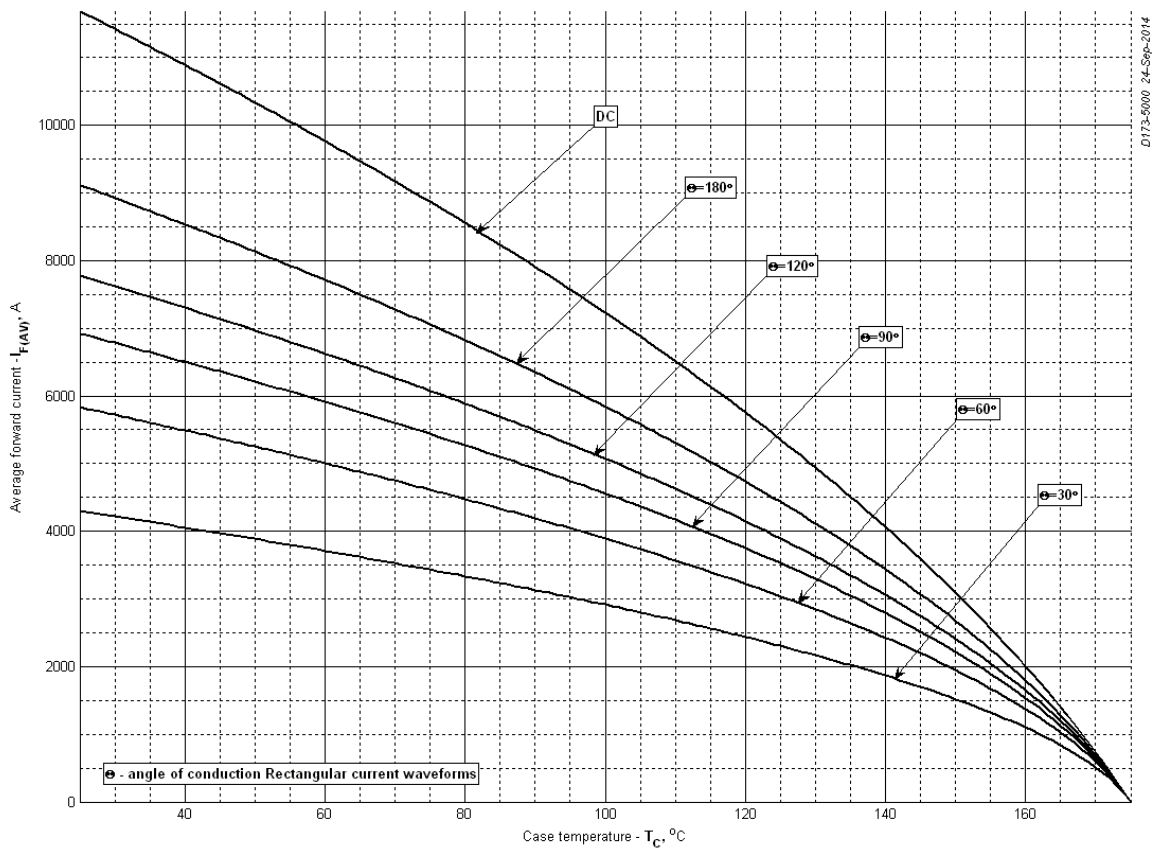
**Fig 8 – Mean forward power dissipation  $P_{FAV}$  vs. Mean forward current  $I_{FAV}$  for rectangular current waveforms at different conduction angles and for DC ( $f=50\text{Hz}$ , DSC)**





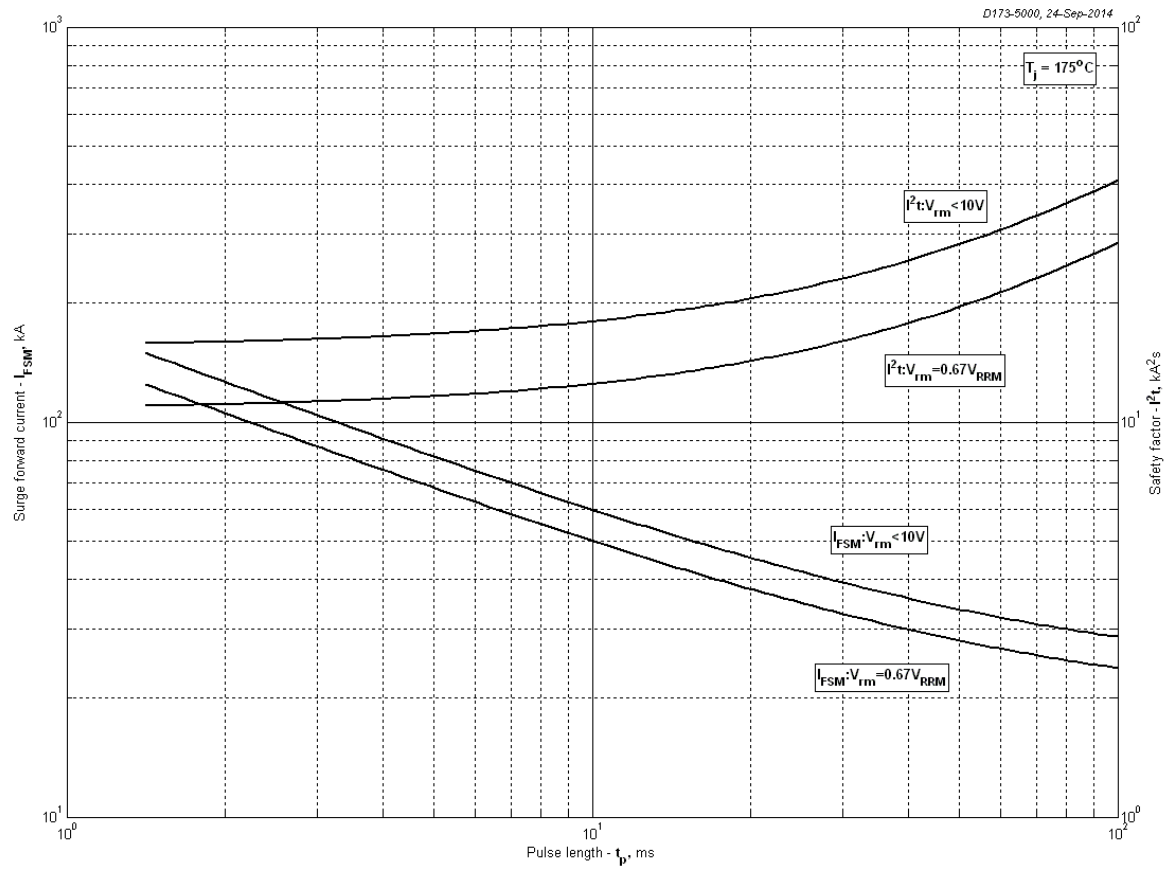
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**Fig 9 – Mean forward current  $I_{FAV}$  vs. Case temperature  $T_C$  for sinusoidal current waveforms at different conduction angles ( $f=50\text{Hz}$ , DSC)**

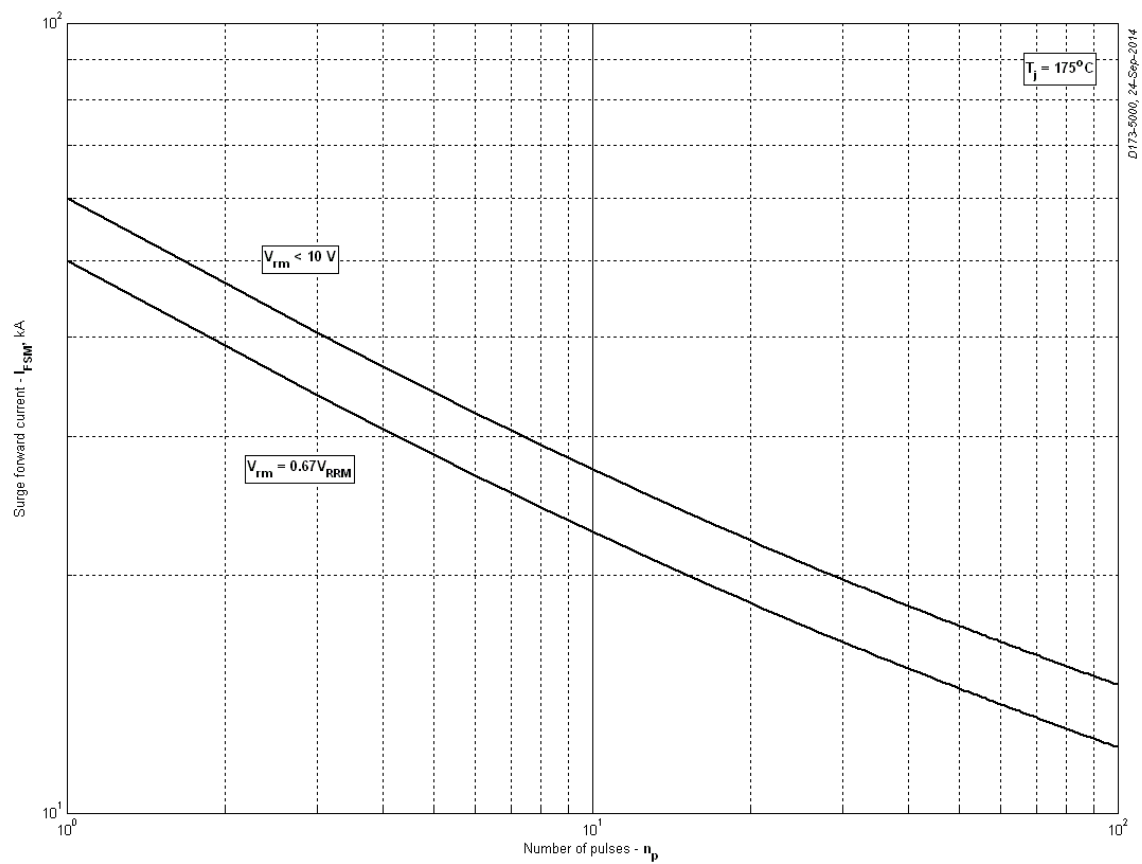


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**Fig 10 - Mean forward current  $I_{FAV}$  vs. Case temperature  $T_C$  for rectangular current waveforms at different conduction angles and for DC ( $f=50\text{Hz}$ , DSC)**



**Fig 11 – Maximum surge and  $I^2t$  ratings**



**Fig 12 - Maximum surge ratings**