**TT330N** **TD330N**

**TT330N16KOF_TIM** **TD330N16KOF_TIM**

**Elektrische Eigenschaften / Electrical properties**

Höchstzulässige Werte / Maximum rated values

| | | | | | |
|---|---|---|---|---|---|
| Periodische Vorwärts- und Rückwärts-Spitzensperrspannung<br>repetitive peak forward off-state and reverse voltages | $T_{vj}$ = -40°C... $T_{vj\,max}$ | $V_{DRM}$,$V_{RRM}$ | 1200<br> | 1400<br>1600 | V<br>V |
| Vorwärts-Stoßspitzensperrspannung<br>non-repetitive peak forward off-state voltage | $T_{vj}$ = -40°C... $T_{vj\,max}$ | $V_{DSM}$ | 1200<br> | 1400<br>1600 | V<br>V |
| Rückwärts-Stoßspitzensperrspannung<br>non-repetitive peak reverse voltage | $T_{vj}$ = +25°C... $T_{vj\,max}$ | $V_{RSM}$ | 1300<br> | 1500<br>1700 | V<br>V |
| Durchlaßstrom-Grenzeffektivwert<br>maximum RMS on-state current | | $I_{TRMSM}$ | | 520 | A |
| Dauergrenzstrom<br>average on-state current | $T_C$ = 85°C | $I_{TAVM}$ | | 330 | A |
| Stoßstrom-Grenzwert<br>surge current | $T_{vj}$ = 25°C, $t_P$ = 10ms<br>$T_{vj}$ = $T_{vj\,max}$, $t_P$ = 10ms | $I_{TSM}$ | | 12500<br>10000 | A<br>A |
| Grenzlastintegral<br>I²t-value | $T_{vj}$ = 25°C, $t_P$ = 10ms<br>$T_{vj}$ = $T_{vj\,max}$, $t_P$ = 10ms | I²t | | 781250<br>500000 | A²s<br>A²s |
| Kritische Stromsteilheit<br>critical rate of rise of on-state current | DIN IEC 747-6<br>f = 50Hz, $i_{GM}$ = 1A, $di_G/dt$ = 1A/µs | $(di_T/dt)_{cr}$ | | 250 | A/µs |
| Kritische Spannungssteilheit<br>critical rate of rise of off-state voltage | $T_{vj}$ = $T_{vj\,max}$, $v_D$ = 0,67 $V_{DRM}$<br>6.Kennbuchstabe / 6th letter F | $(dv_D/dt)_{cr}$ | | 1000 | V/µs |

Charakteristische Werte / Characteristic values

| | | | | | |
|---|---|---|---|---|---|
| Durchlaßspannung<br>on-state voltage | $T_{vj}$ = $T_{vj\,max}$ , $i_T$ = 800 A | $v_T$ | max. | 1,28 | V |
| Schleusenspannung<br>threshold voltage | $T_{vj}$ = $T_{vj\,max}$ | $V_{(TO)}$ | max. | 0,8 | V |
| Ersatzwiderstand<br>slope resistance | $T_{vj}$ = $T_{vj\,max}$ | $r_T$ | max. | 0,5 | mΩ |
| Zündstrom<br>gate trigger current | $T_{vj}$ = 25°C, $v_D$ = 12V | $I_{GT}$ | max. | 200 | mA |
| Zündspannung<br>gate trigger voltage | $T_{vj}$ = 25°C, $v_D$ = 12V | $V_{GT}$ | max. | 2 | V |
| Nicht zündender Steuerstrom<br>gate non-trigger current | $T_{vj}$ = $T_{vj\,max}$ , $v_D$ = 12V<br>$T_{vj}$ = $T_{vj\,max}$ , $v_D$ = 0,5 $V_{DRM}$ | $I_{GD}$ | max.<br>max. | 10<br>5 | mA<br>mA |
| Nicht zündende Steuerspannung<br>gate non-trigger voltage | $T_{vj}$ = $T_{vj\,max}$ , $v_D$ = 0,5 $V_{DRM}$ | $V_{GD}$ | max. | 0,2 | V |
| Haltestrom<br>holding current | $T_{vj}$ = 25°C, $v_D$ = 12V, $R_A$ = 1Ω | $I_H$ | max. | 300 | mA |
| Einraststrom<br>latching current | $T_{vj}$ = 25°C, $v_D$ = 12V, $R_{GK}$ ≥ 10Ω<br>$i_{GM}$ = 1A, $di_G/dt$ = 1A/µs, $t_g$ = 20µs | $I_L$ | max. | 1200 | mA |
| Vorwärts- und Rückwärts-Sperrstrom<br>forward off-state and reverse current | $T_{vj}$ = $T_{vj\,max}$<br>$v_D$ = $V_{DRM}$, $v_R$ = $V_{RRM}$ | $i_D$, $i_R$ | max. | 70 | mA |
| Zündverzug<br>gate controlled delay time | DIN IEC 747-6<br>$T_{vj}$ = 25°C, $i_{GM}$ = 1A, $di_G/dt$ = 1A/µs | $t_{gd}$ | max. | 3 | µs |

| | | | | |
|---|---|---|---|---|
| prepared by: | AG | | date of publication: | 2017-07-06 |
| approved by: | MS | | revision: | 3.5 |

**Elektrische Eigenschaften / Electrical properties**

Charakteristische Werte / Characteristic values

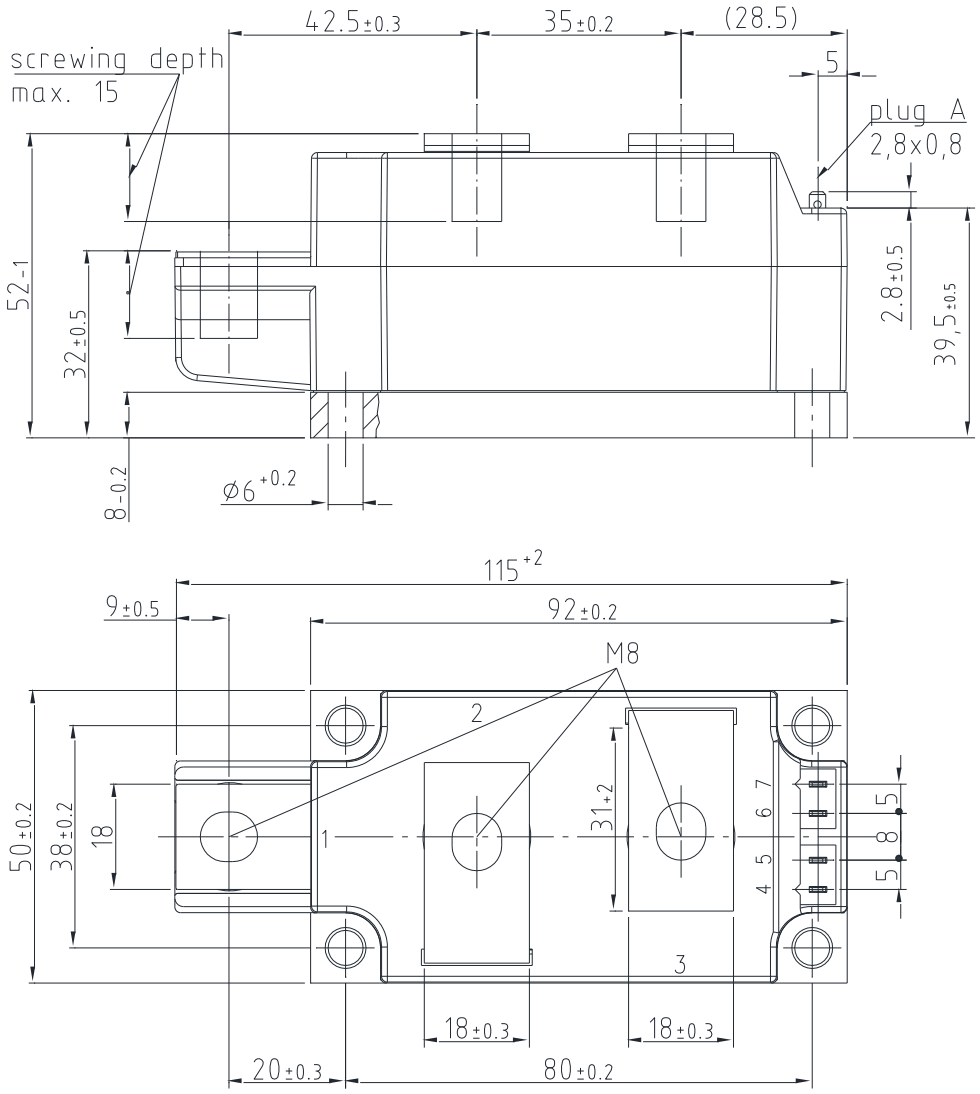
| | | | | | |
|---|---|---|---|---|---|
| Freiwerdezeit<br>circuit commutated turn-off time | $T_{vj} = T_{vj\,max}$, $i_{TM} = I_{TAVM}$<br>$v_{RM}$ = 100 V, $v_{DM}$ = 0,67 $V_{DRM}$<br>$dv_D/dt$ = 20 V/µs, $-di_T/dt$ = 10 A/µs<br>5.Kennbuchstabe / 5th letter O | $t_q$ | typ. | 250 | µs |
| Isolations-Prüfspannung<br>insulation test voltage | RMS, f = 50 Hz, t = 1min<br>RMS, f = 50 Hz, t = 1sec | $V_{ISOL}$ | | 3,0<br>3,6 | kV<br>kV |

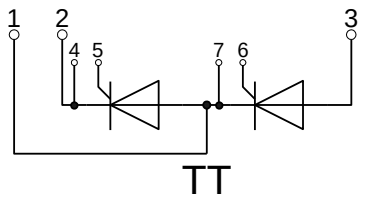
**Thermische Eigenschaften / Thermal properties**

| | | | | | |
|---|---|---|---|---|---|
| Innerer Wärmewiderstand<br>thermal resistance, junction to case | pro Modul / per Module, Θ = 180° sin<br>pro Zweig / per arm, Θ = 180° sin<br>pro Modul / per Module, DC<br>pro Zweig / per arm, DC | $R_{thJC}$ | max.<br>max.<br>max.<br>max. | 0,056<br>0,112<br>0,053<br>0,106 | K/W<br>K/W<br>K/W<br>K/W |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink | pro Modul / per Module<br>pro Zweig / per arm | $R_{thCH}$ | max.<br>max. | 0,02<br>0,04 | K/W<br>K/W |
| Übergangs-Wärmewiderstand mit TIM<br>thermal resistance, case to heatsink, with TIM | pro Modul / per Module<br>pro Zweig / per arm | | max.<br>max. | 0,015<br>0,030 | K/W<br>K/W |
| Höchstzulässige Sperrschichttemperatur<br>maximum junction temperature | | $T_{vj\,max}$ | | 130 | °C |
| Betriebstemperatur<br>operating temperature | | $T_{c\,op}$ | | -40...+130 | °C |
| Lagertemperatur<br>storage temperature | | $T_{stg}$ | | -40...+130 | °C |
| Lagertemperatur mit TIM<br>storage temperature with TIM | | | | +5…+50 | °C |

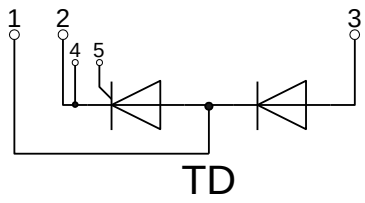
**Mechanische Eigenschaften / Mechanical properties**

| | | | | | |
|---|---|---|---|---|---|
| Gehäuse, siehe Anlage<br>case, see annex | | | | Seite 4<br>page 4 | |
| Si-Element mit Druckkontakt<br>Si-pellet with pressure contact | | | | | |
| Innere Isolation<br>internal insulation | Basisisolierung (Schutzklasse 1, EN61140)<br>Basic insulation (class 1, IEC61140) | | | AlN | |
| Anzugsdrehmoment für mechanische Anschlüsse<br>mounting torque | Toleranz / Tolerance ± 15% | M1 | | 5 | Nm |
| Anzugsdrehmoment für elektrische Anschlüsse<br>terminal connection torque | Toleranz / Tolerance ± 10% | M2 | | 12 | Nm |
| Steueranschlüsse<br>control terminals | DIN 46 244 | | | A 2,8 x 0,8 | |
| Gewicht<br>weight | | G | typ. | 800 | g |
| Kriechstrecke<br>creepage distance | | | | 17 | mm |
| Schwingfestigkeit<br>vibration resistance | f = 50 Hz | | | 50 | m/s² |
| | file-No. | | | E 83335 | |


42.5±0.3
35±0.2
(28.5)
5
screwing depth
max. 15
plug A
2,8x0,8
52-1
32±0.5
2.8±0.5
39,5±0.5
8-0.2
Ø6+0.2
115+2
9±0.5
92±0.2
M8
2
1
3
50±0.2
38±0.2
18
31+2
6.7
4.5
5.8
18±0.3
18±0.3
20±0.3
80±0.2


1
2
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4
5
7
6

TT


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TD

**Analytische Elemente des transienten Wärmewiderstandes $Z_{thJC}$ für DC**
**Analytical elements of transient thermal impedance $Z_{thJC}$ for DC**

| Pos. n | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| $R_{thn}$ [K/W] | 0,037 | 0,034 | 0,024 | 0,0088 | 0,002 | | |
| $\tau_n$ [s] | 5,4 | 0,9 | 0,12 | 0,006 | 0,0009 | | |

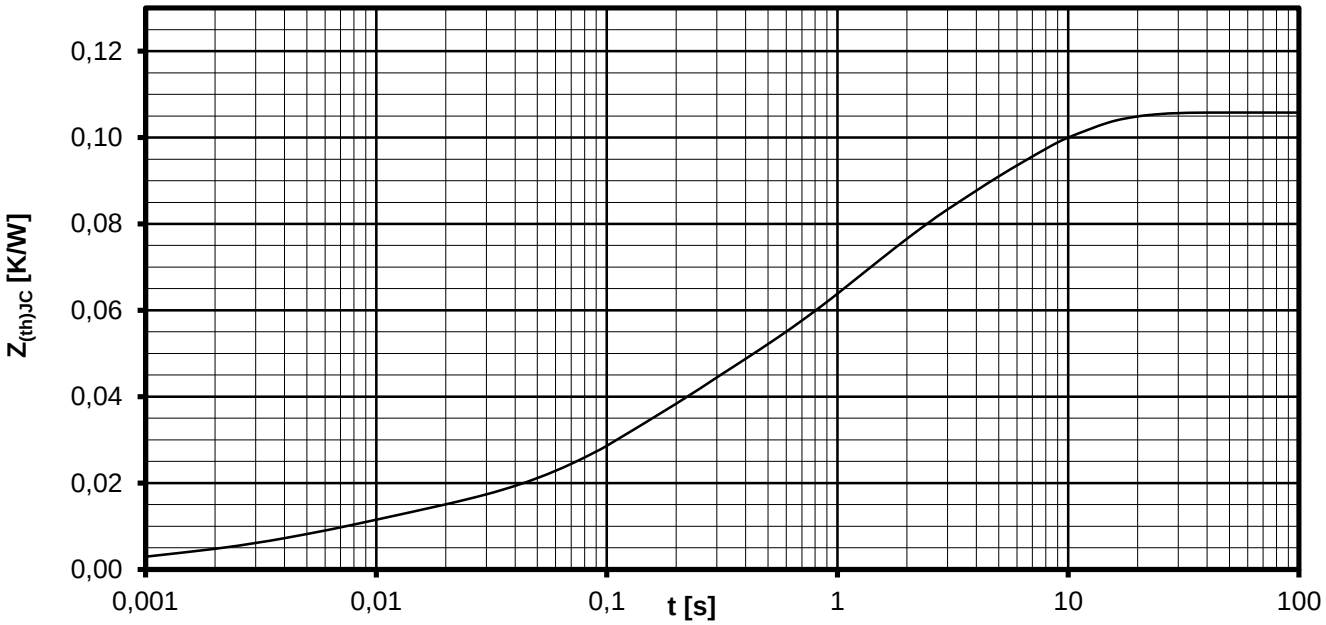
Analytische Funktion / Analytical function:

$$Z_{thJC} = \sum_{n=1}^{n_{max}} R_{thn} \left[ 1 - e^{\frac{-t}{\tau_n}} \right]$$

**Erhöhung des $Z_{th\ DC}$ bei Sinus und Rechteckströmen mit unterschiedlichen Stromflusswinkeln Θ**
**Rise of $Z_{th\ DC}$ for sinewave and rectangular current with different current conduction angles Θ**
**$\Delta Z_{th\ \Theta\ rec}$ / $\Delta Z_{th\ \Theta\ sin}$**

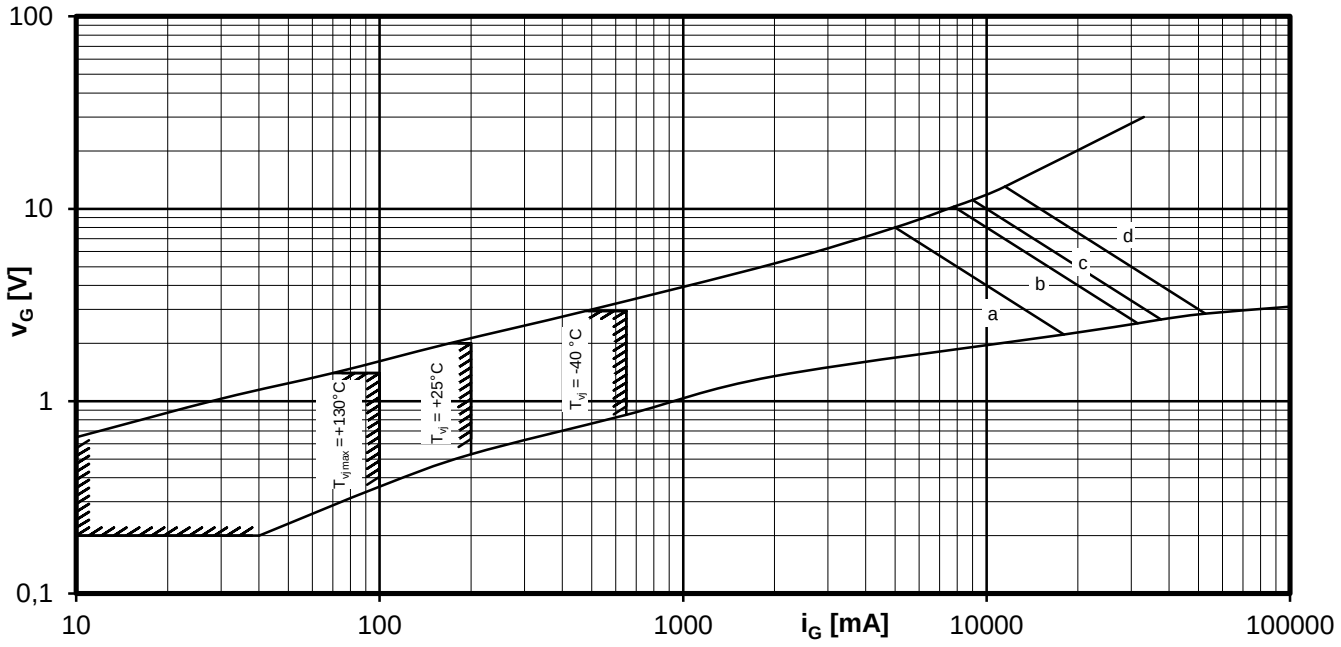
| | Θ = 180° | Θ = 120° | Θ = 90° | Θ = 60° | Θ = 30° |
|---|---|---|---|---|---|
| $\Delta Z_{th\ \Theta\ rec}$ [K/W] | 0,00923 | 0,01520 | 0,01966 | 0,02643 | 0,03830 |
| $\Delta Z_{th\ \Theta\ sin}$ [K/W] | 0,00620 | 0,00888 | 0,01241 | 0,01829 | 0,03094 |

$$Z_{th\ \Theta\ rec} = Z_{th\ DC} + \Delta Z_{th\ \Theta\ rec}$$
$$Z_{th\ \Theta\ sin} = Z_{th\ DC} + \Delta Z_{th\ \Theta\ sin}$$




**Transienter innerer Wärmewiderstand je Zweig / Transient thermal impedance per arm $Z_{thJC} = f(t)$**

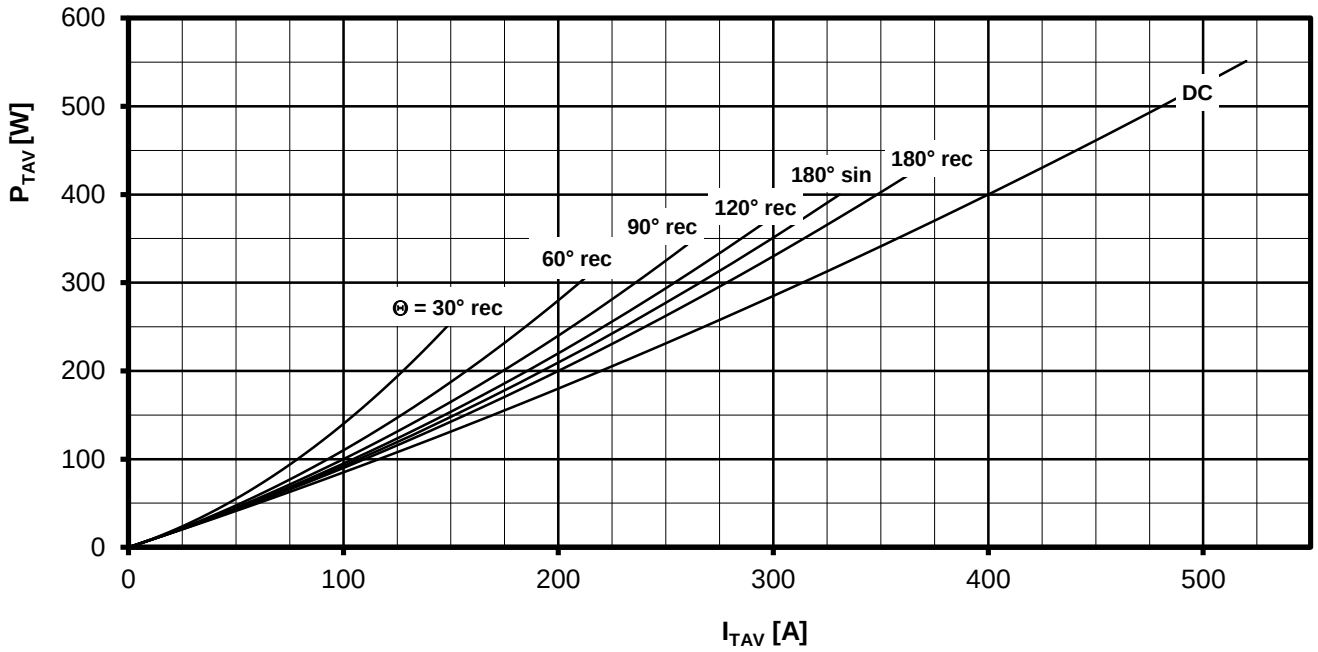
Parameter: Stromflußwinkel Θ / Current conduction angle Θ




**Steuercharakteristik $v_G = f(i_G)$ mit Zündbereichen für $V_D$ = 12 V**
**Gate characteristic $v_G = f(i_G)$ with triggering area for $V_D$ = 12 V**

Höchstzulässige Spitzensteuerverlustleistung / Maximum rated peak gate power dissipation $P_{GM} = f(t_g)$ :

a - 20W/10ms b - 40W/1ms c - 60W/0,5ms

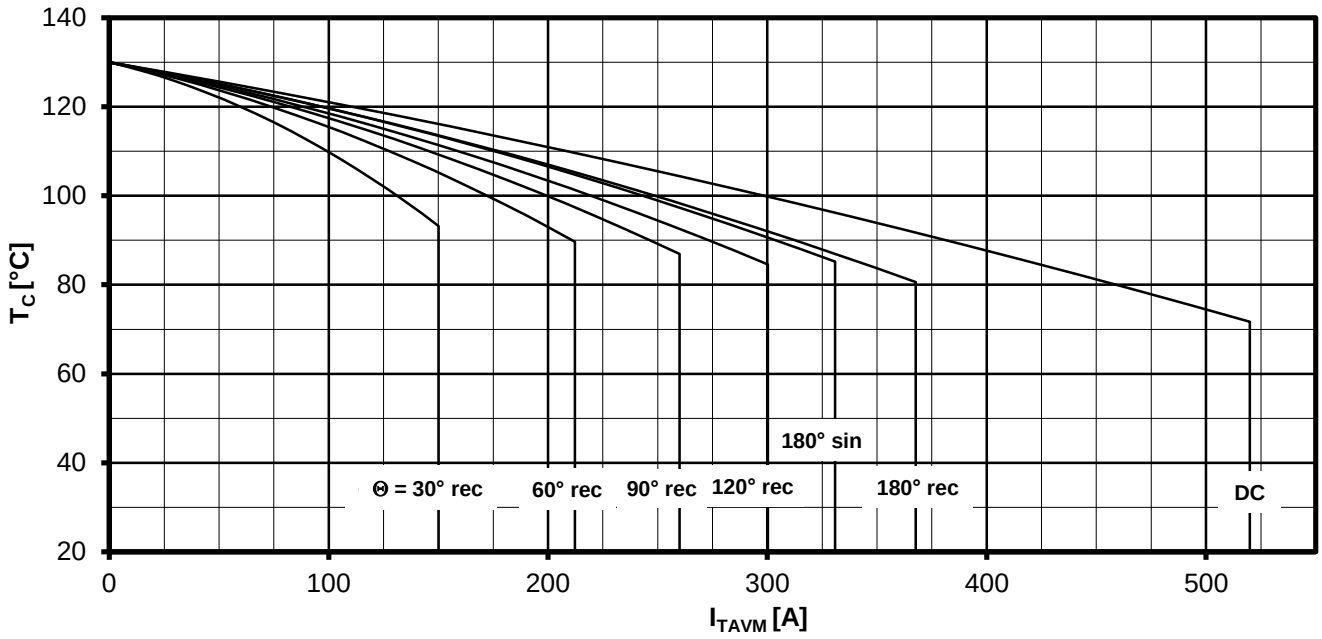



**Durchlassverlustleistung je Zweig / On-state power loss per arm $P_{TAV} = f(I_{TAV})$**

Strombelastung je Zweig / Current load per arm

**Berechnungsgrundlage $P_{TAV}$ (Schaltverluste gesondert berücksichtigen)**
**Calculation base $P_{TAV}$ (switching losses should be considered separately)**

Parameter: Stromflußwinkel / Current conduction angle Θ




**Höchstzulässige Gehäusetemperatur / Maximum allowable case temperature $T_C = f(I_{TAVM})$**

Strombelastung je Zweig / Current load per arm

**Berechnungsgrundlage $P_{TAV}$ (Schaltverluste gesondert berücksichtigen)**
**Calculation base $P_{TAV}$ (switching losses should be considered separately)**

Parameter: Stromflußwinkel Θ / Current conduction angle Θ