# Technische Information / Technical Information

eupec

Netz-Thyristor
Phase Control Thyristor

# T 829 N 20 ...26

N

**Elektrische Eigenschften / 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...$T_{vj\,max}$ | $V_{DRM}$ , $V_{RRM}$ | 2000<br>2400 | 2200<br>2600 | V<br>V 1) |
| Vorwärts-Stoßspitzensperrspannung<br>non-repetitive peak foward off-state voltage | $T_{vj}$ = - 40°C...$T_{vj\,max}$ | $V_{DSM}$ | 2000<br>2400 | 2200<br>2600 | V<br>V |
| Rückwärts-Stoßspitzensperrspannung<br>non-repetitive peak reverse voltage | $T_{vj}$ = + 25°C...$T_{vj\,max}$ | $V_{RSM}$ | 2100<br>2500 | 2300<br>2700 | V<br>V |
| Durchlaßstrom-Grenzeffektivwert<br>RMSM on-state current | | $I_{TRSMSM}$ | | 1800 | A |
| Dauergrenzstrom<br>average on-state current | $T_C$ = 85 °C<br>$T_C$ = 60 °C | $I_{TAVM}$ | | 829<br>1145 | A<br>A |
| Stoßstrom-Grenzwert<br>surge current | $T_{vj}$ = 25°C, $t_p$ = 10 ms<br>$T_{vj}$ = $T_{vj\,max}$, $t_p$ = 10 ms | $I_{TSM}$ | | 17500<br>15500 | A<br>A |
| Grenzlastintegral<br>I²t-value | $T_{vj}$ = 25°C, $t_p$ = 10ms<br>$T_{vj}$ = $T_{vj\,max}$, $t_p$ = 10ms | I²t | | 1531<br>1201 | A²s *10⁻³<br>A²s *10⁻³ |
| Kritische Stromsteilheit<br>critical rate of rise of on-state current | DIN IEC 747-6<br>f=50 Hz, $v_L$ = 10V, $i_{GM}$ = 1 A<br>$di_G/dt$ = 1 A/µs | $(di_T/dt)_{cr}$ | | 50 | 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>5.Kennbuchstabe / 5th letter F | $(dv_D/dt)_{cr}$ | | 1000 | V/µs |

Charakteristische Werte / Characteristic values

| | | | | | |
|---|---|---|---|---|---|
| Durchlaßspannung<br>on-state voltage | $T_{vj}$ = $T_{vj\,max}$, $i_T$ = 1800 A | $v_T$ | max. | 1,78 | V |
| Schleusenspannung<br>threshold voltage | $T_{vj}$ = $T_{vj\,max}$ | $V_{T(TO)}$ | | 0,95 | V |
| Ersatzwiderstand<br>slope resistance | $T_{vj}$ = $T_{vj\,max}$ | $r_T$ | | 0,425 | mΩ |
| Durchlaßkennlinie<br>on-state voltage<br>$v_T = A + B \times i_T + C \times \ln(i_T + 1) + D \times \sqrt{i_T}$ | $T_{vj}$ = $T_{vj\,max}$ | A= 1,0069<br>B= 3,381E-04<br>C=-0,02723<br>D= 8,5423E-03 | | | |
| Zündstrom<br>gate trigger current | $T_{vj}$ = 25°C, $v_D$ = 6 V | $I_{GT}$ | max. | 250 | mA |
| Zündspannung<br>gate trigger voltage | $T_{vj}$ = 25°C, $v_D$ = 6V | $V_{GT}$ | max. | 1,5 | V |
| Nicht zündener Steuerstrom<br>gate non-trigger current | $T_{vj}$ = $T_{vj\,max}$, $v_D$ = 6 V<br>$T_{vj}$ = $T_{vj\,max}$,$v_D$ = 0,5 $V_{DRM}$ | $I_{GD}$ | max.<br>max. | 10<br>5 | mA<br>mA |
| Nicht zündene Steuerspannung<br>gate non-trigger voltage | $T_{vj}$ = $T_{vj\,max}$,$v_D$ = 0,5 $V_{DRM}$ | $V_{GD}$ | max. | 0,2 | mV |
| Haltestrom<br>holding current | $T_{vj}$ = 25°C, $v_D$ = 6 V, $R_A$ = 5 Ω | $I_H$ | max. | 600 | mA |
| Einraststrom<br>latching current | $T_{vj}$ = 25°C, $v_D$ = 6 V, $R_{GK>}$= 10 Ω<br>$i_{GM}$ = 1 A, $di_G/dt$ = 1 A/µs<br>$t_g$ = 20 µs | $I_L$ | max. | 2000 | mA |
| Vorwärts- und Rückwärts-Sperrstrom<br>forward off-state and reverse currents | $T_{vj}$ = $T_{vj\,max}$<br>$v_D$ = $V_{DRM}$, vR = $V_{RRM}$ | $i_D$, $i_R$ | max. | 100 | mA |
| Zündverzug<br>gate controlled delay time | DIN IEC 747-6<br>$T_{vj}$ = 25°C<br>$i_{GM}$ = 1 A, $di_G/dt$ = 1 A/µs | $t_{gd}$ | max. | 4 | µs |

### Elektrische Eigenschften / Electrical properties

Charakteristische Werte / Characteristic values

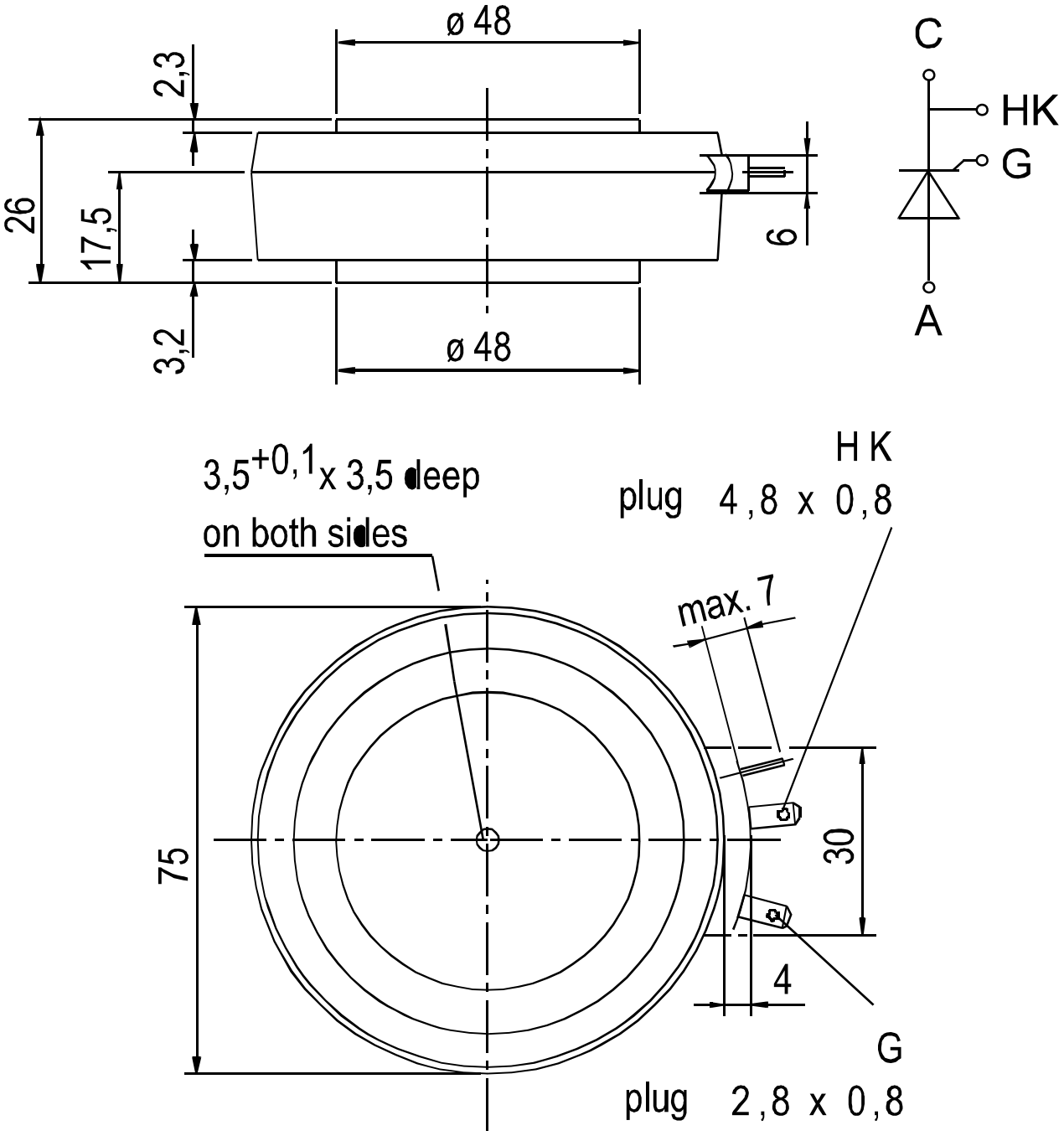
| | | | | | |
|---|---|---|---|---|---|
| Freiwerdezeit<br>circuit commutatet turn-off time | $T_{vj} = T_{vj\,max}$, $i_{TM}=I_{TAVM}$<br>$v_{RM}$ =100V, $v_{DM}$ = 0,67 $V_{DRM}$<br>$dv_D/dt$ = 20 V/µs, $-di_T/dt$ = 10 A/µs<br>4. Kennbuchstabe / 4th letter O | $t_q$ | typ. | 350 | µs |

### Thermische Eigenschaften / Thermal properties

| | | | | | |
|---|---|---|---|---|---|
| Innerer Wärmewiderstand<br>thermal resitance, junction to case | Kühlfläche / cooling surface<br>beidseitig / two-sided, θ=180°sin<br>beidseitig / two-sided, DC<br>Anode / anode, ? =180°sin<br>Anode / anode, DC<br>Kathode / cathode, θ=180°sin<br>Kathode / cathode, DC | $R_{thJC}$ | <br>max.<br>max.<br>max.<br>max.<br>max.<br>max. | <br>0,0265<br>0,0240<br>0,0445<br>0,0420<br>0,0585<br>0,0560 | <br>°C/W<br>°C/W<br>°C/W<br>°C/W<br>°C/W<br>°C/W |
| Übergangs- Wärmewiderstand<br>thermal resitance, case to heatsink | Kühlfläche / cooling surface<br>beidseitig / two-sided<br>einseitig / single-sided | $R_{thCK}$ | <br>max.<br>max. | <br>0,0035<br>0,0070 | <br>°C/W<br>°C/W |
| Höchstzulässige Sperrschichttemperatur<br>max. junction temperature | | $T_{vj\,max}$ | | 125 | °C |
| Betriebstemperatur<br>operating temperature | | $T_{c\,op}$ | | -40...125 | °C |
| Lagertemperatur<br>storage temperature | | $T_{stg}$ | | -40...140 | °C |

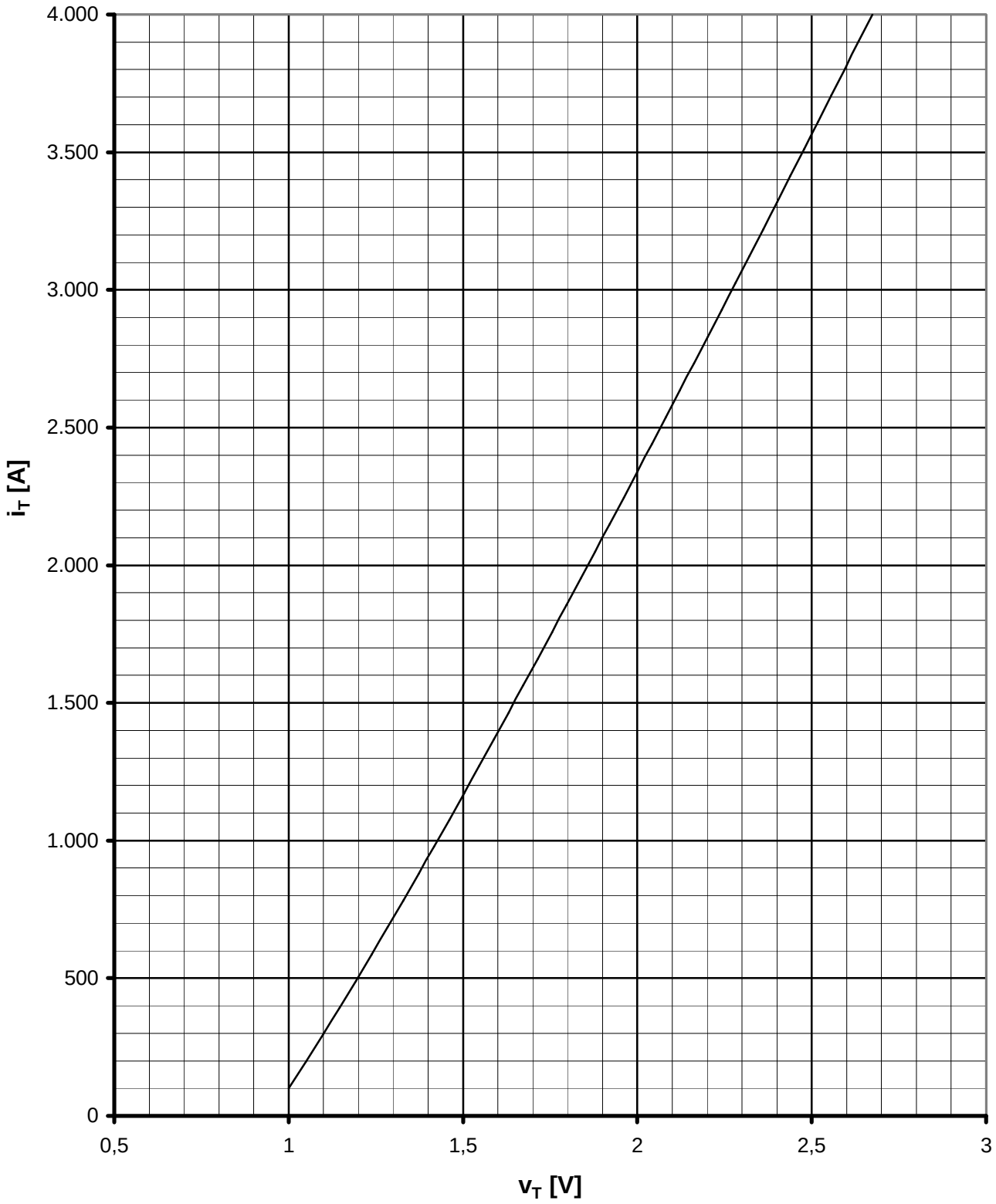
### Mechanische Eigenschaften / Mechanical properties

| | | | | | |
|---|---|---|---|---|---|
| Gehäuse, siehe Anlage<br>case, see appendix | | | | Seite 3<br>page 3 | |
| Si-Element mit Druckkontakt<br>Si-pellet with pressure contact | | | | | |
| Anpreßkraft<br>clamping force | | F | | 12 ...24 | kN |
| Gewicht<br>weight | | G | typ. | 540 | g |
| Kriechstrecke<br>creepage distance | | | | 32 | mm |
| Feuchteklasse<br>humidity classification | DIN 40040 | | | C | |
| Schwingfestigkeit<br>vibration resistance | f = 50Hz | | | 50 | m/s² |

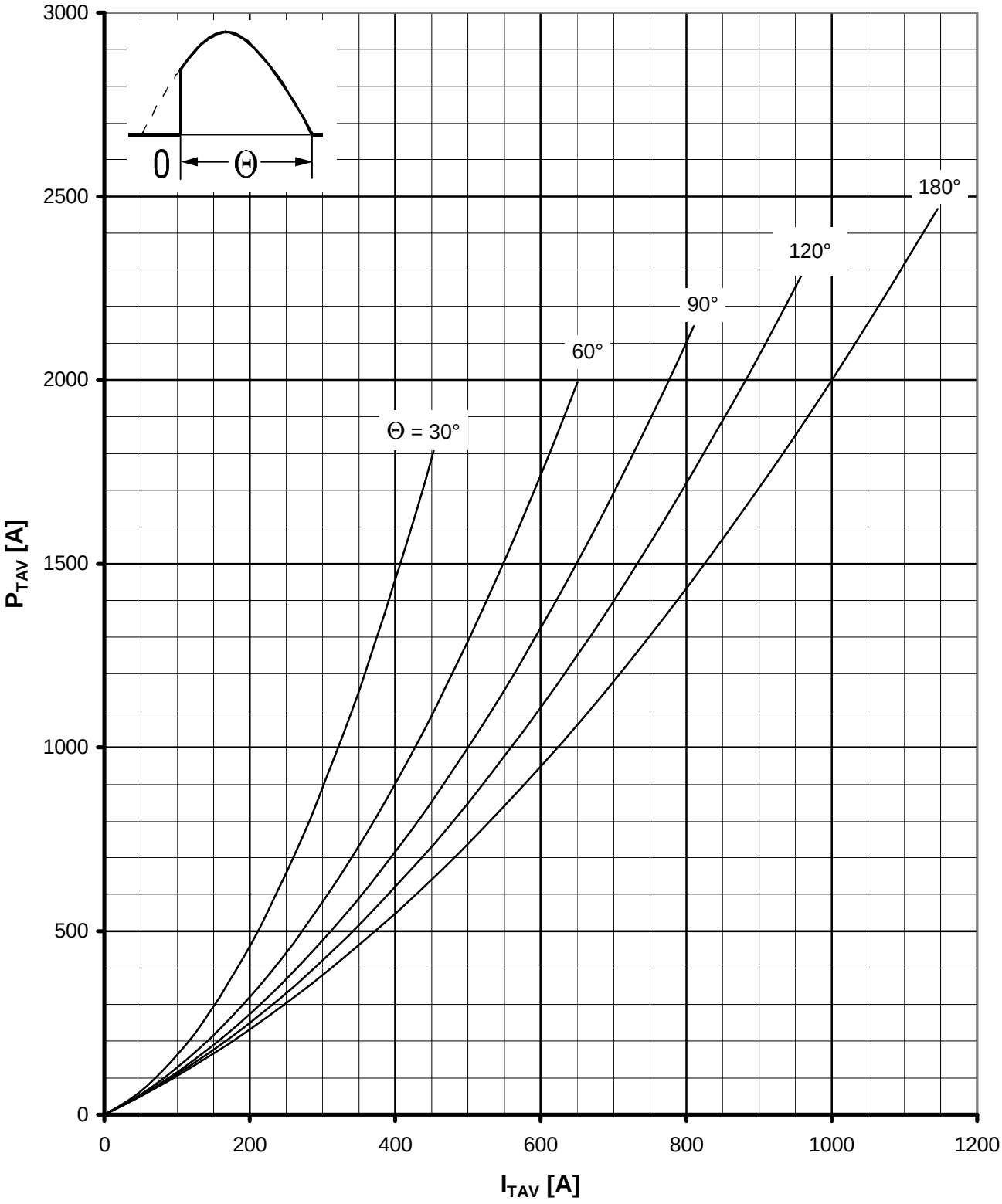

ø 48
2,3
26
17,5
3,2
6
ø 48
C
HK
G
A
3,5+0,1 x 3,5 deep
on both sides
H K
plug 4,8 x 0,8
max. 7
75
30
4
G
plug 2,8 x 0,8

| Kühlung<br>cooling | Analytische Elemente des transienten Wärmewiderstandes $Z_{thJC}$ für DC<br>Analytical ementes of transient thermal impedance$Z_{thJC}$ for DC | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pos.n | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| beidseitig | $R_{thn}$ [°C/W] | 0,001230 | 0,002720 | 0,003330 | 0,008230 | 0,008490 | | |
| two-sided | $\tau_n$ [s] | 0,001460 | 0,005630 | 0,060900 | 0,239000 | 1,240000 | | |
| anodenseitig | $R_{thn}$ [°C/W] | 0,001200 | 0,002720 | 0,003580 | 0,009650 | 0,004650 | | |
| anode-sided | $\tau_n$ [s] | 0,001440 | 0,005470 | 0,061100 | 0,276000 | 4,300000 | | |
| kathodenseitig | $R_{thn}$ [°C/W] | 0,001280 | 0,002910 | 0,009550 | 0,003560 | 0,038700 | | |
| cathode-sided | $\tau_n$ [s] | 0,001470 | 0,006130 | 0,134000 | 0,741000 | 8,810000 | | |

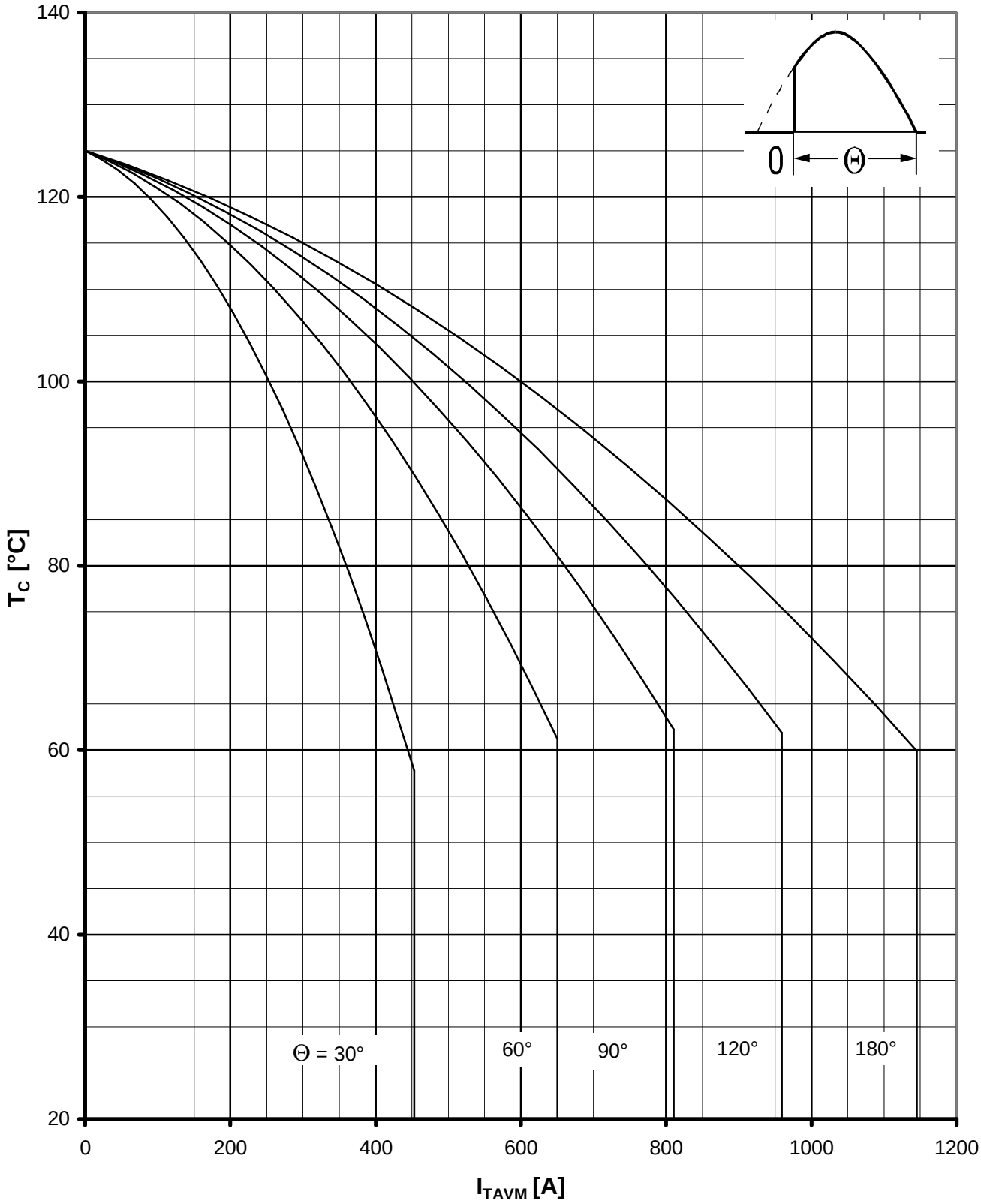
Analytische Funktion / analytical function : $Z_{thJC} = \sum_{n=1}^{n_{max}} R_{thn} ( 1 - EXP ( - t / \tau_n ))$



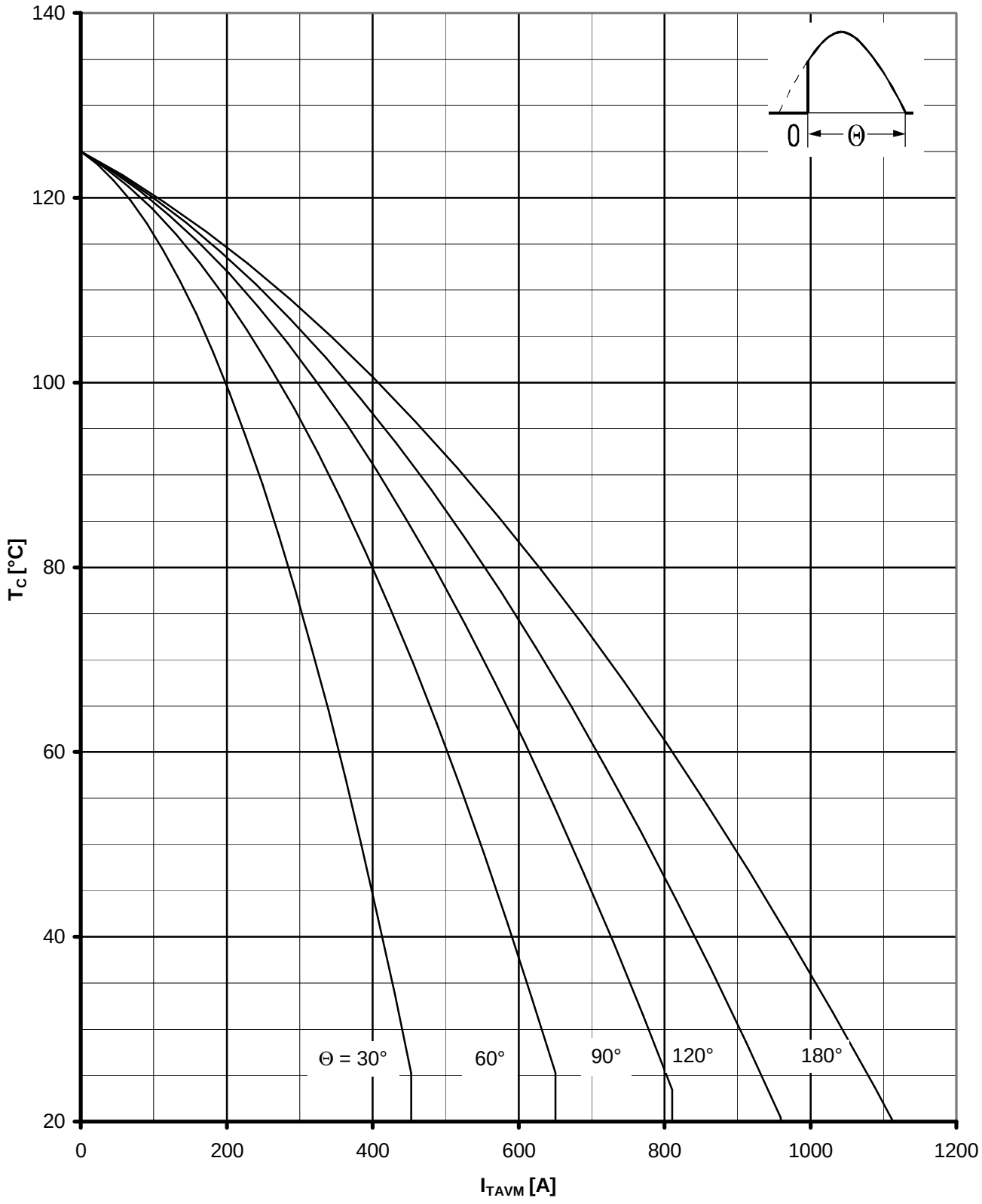

Grenzdurchlaßkennlinie / Limiting 0n-state characteristics $i_T = f(v_T)$
$T_{vj} = T_{vj}$ max



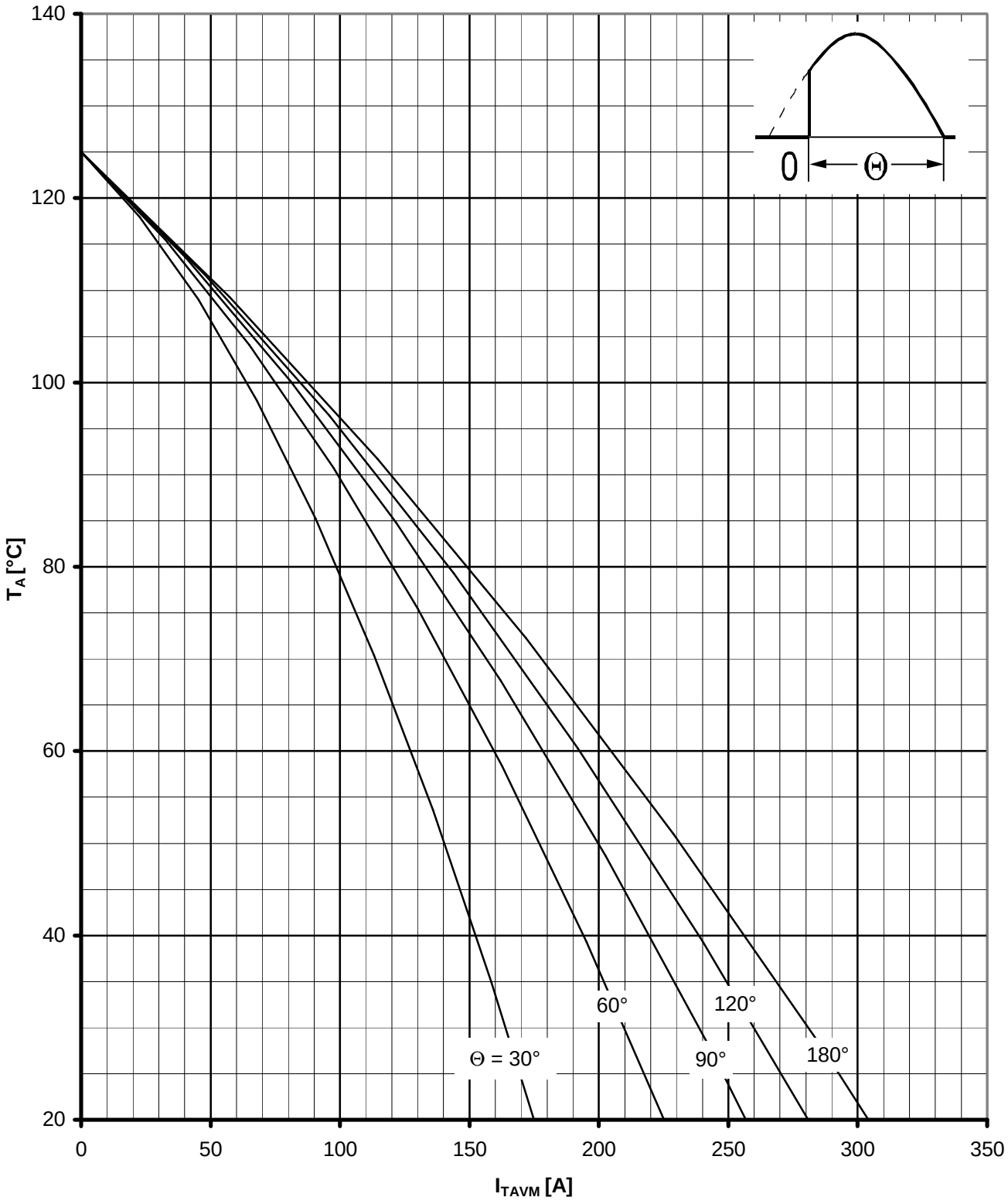

Durchlaßverlustleistung / On-state power loss $P_{TAV} = f(I_{TAV})$
Parameter: Stromflußwinkel Θ / current conduction angle Θ




Höchstzulässige Gehäusetemperatur / Maximum allowable case temperature $T_C = f(I_{TAVM})$
Beidseitige Kühlung / Two-sided cooling
Parameter: Stromflußwinkel Θ / current conduction angle Θ




Höchstzulässige Gehäusetemperatur / Maximum allowable case temperature $T_C = f(I_{TAVM})$
Anodenseitige Kühlung / anode sided cooling
Parameter: Stromflußwinkel Θ / current conduction angle Θ

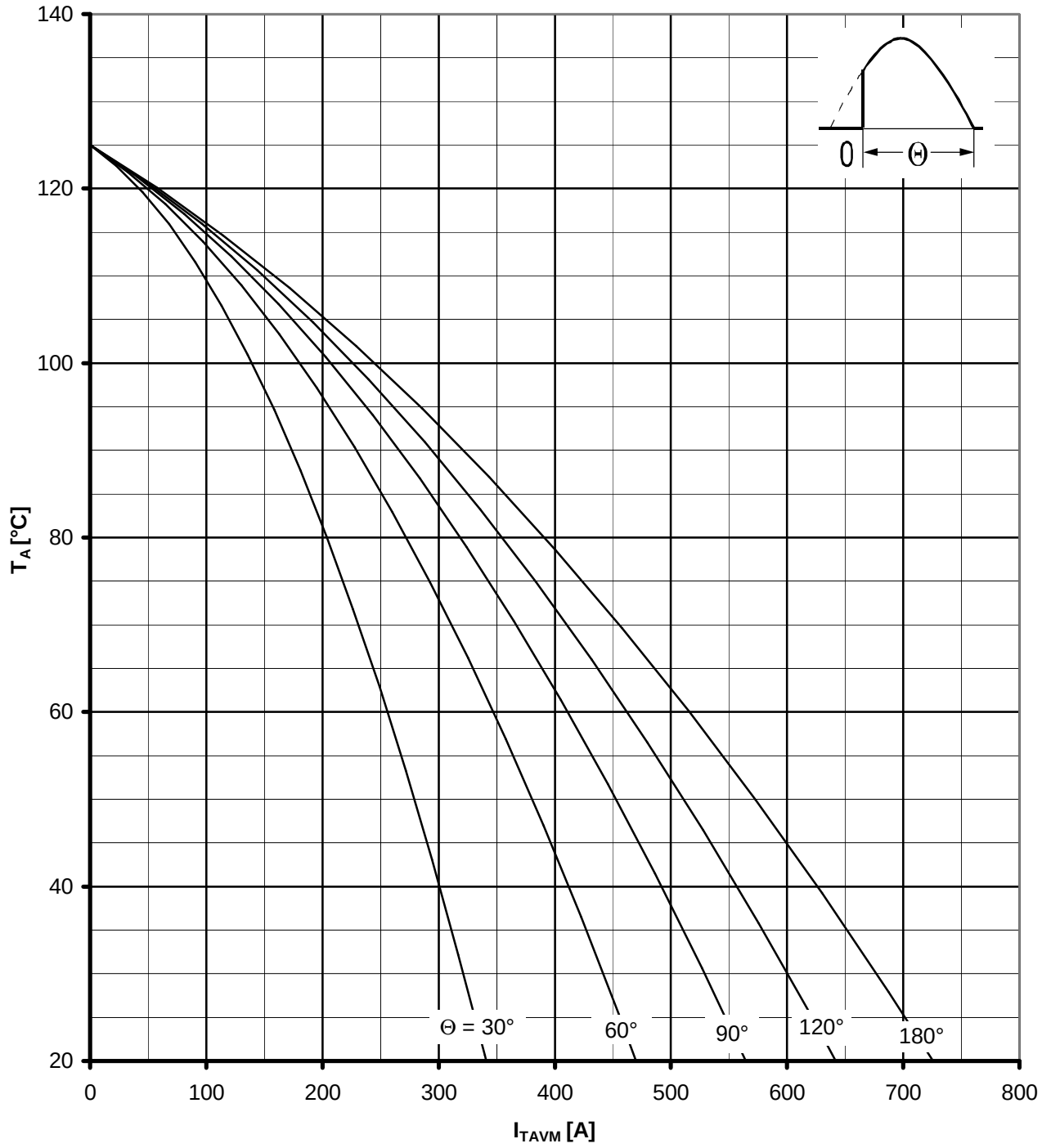



Höchstzulässige Kühlmitteltemperatur / Max. allowable cooling medium temperature $T_A = f(I_{TAVM})$

Luftselbstkühlung / Natural air-cooling

Kühlkörper/Heatsink. K0.05 F

Parameter: Stromflußwinkel Θ / current conduction angle Θ

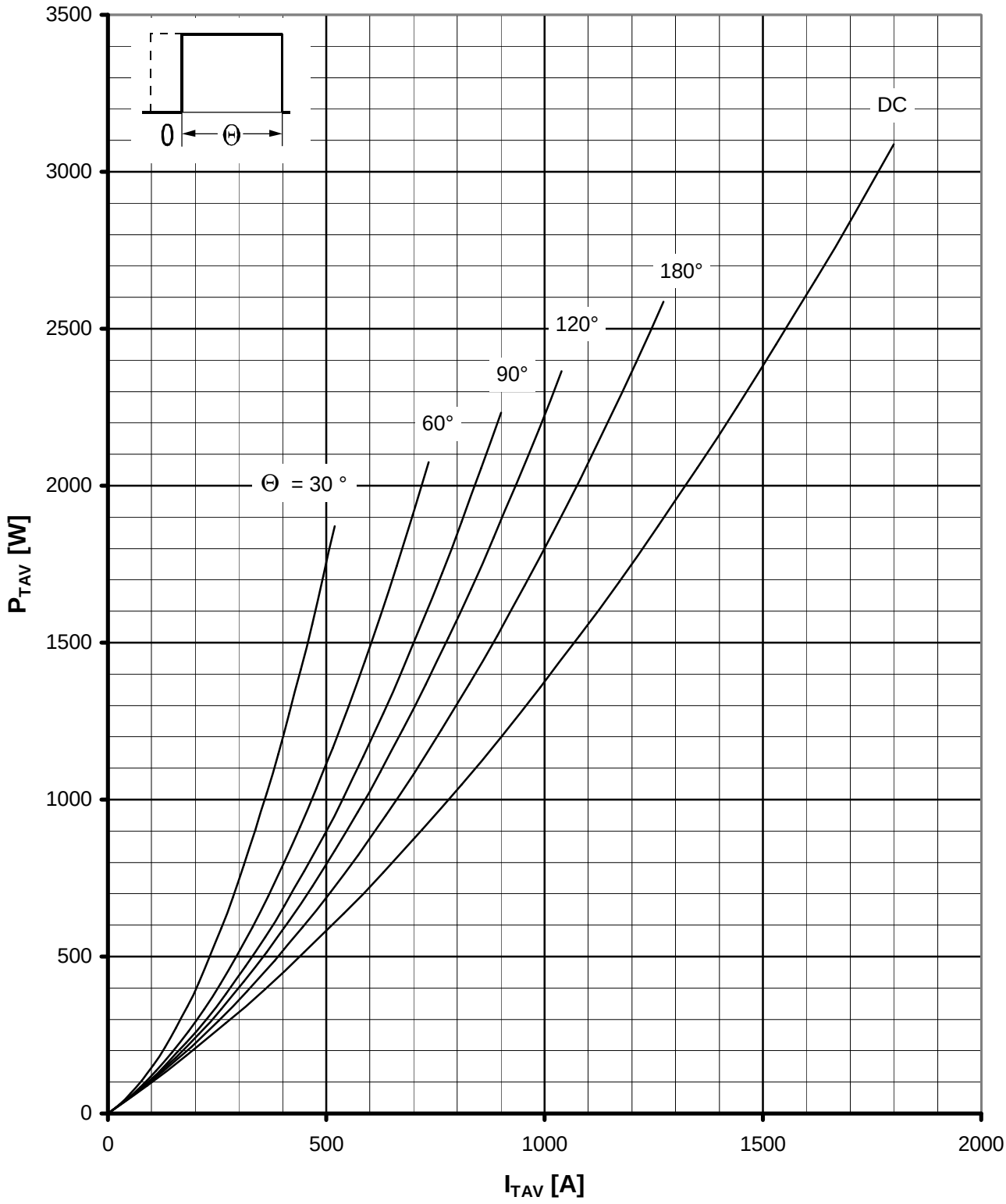



Höchstzulässige Kühlmitteltemperatur / Max. allowable cooling medium temperature $T_A = f(I_{TAVM})$

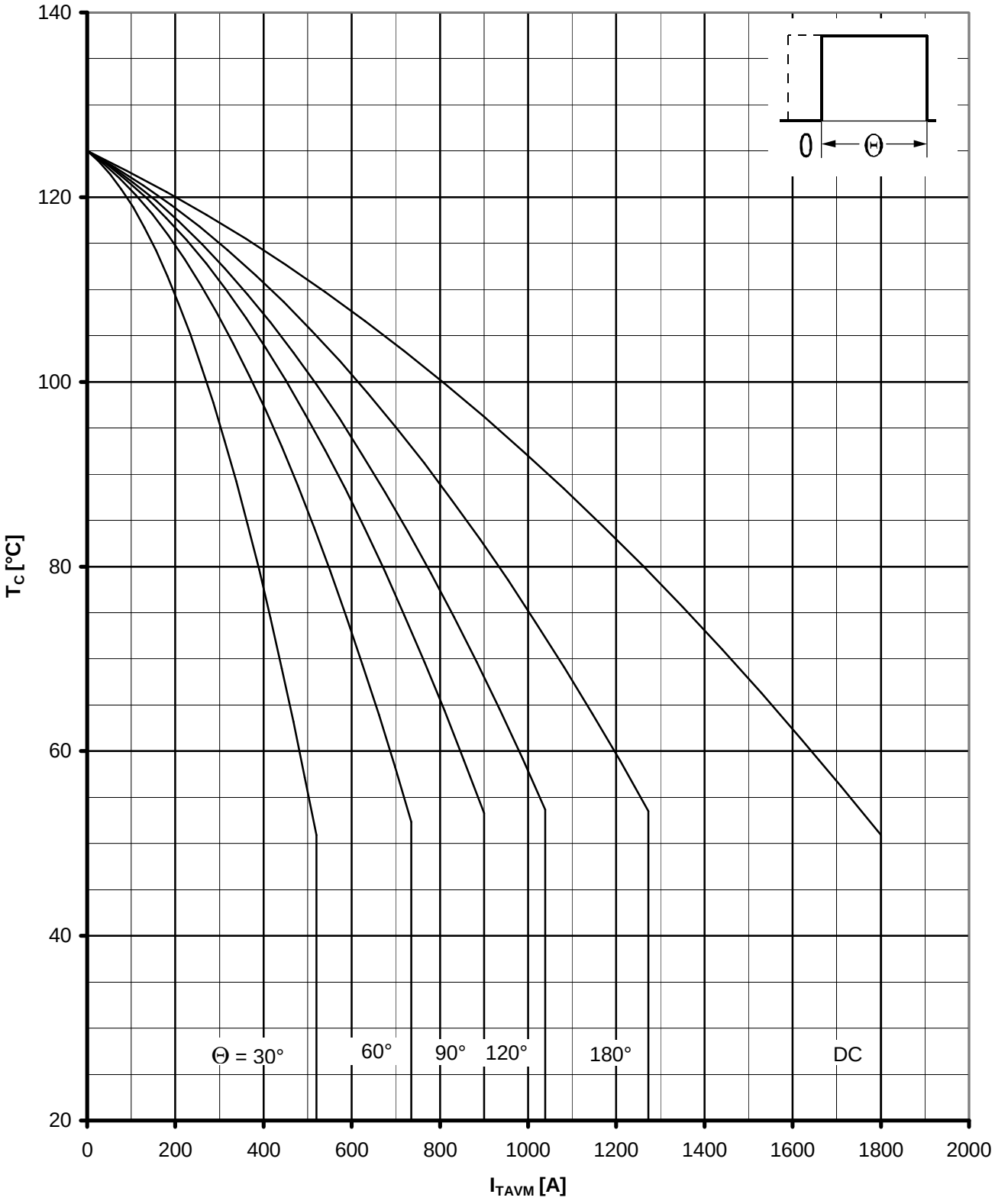
Verstärkte Luftkühlung / Forced air-cooling

Kühlkörper/Heatsink. K0.05F, $V_L$ = 120 l/s

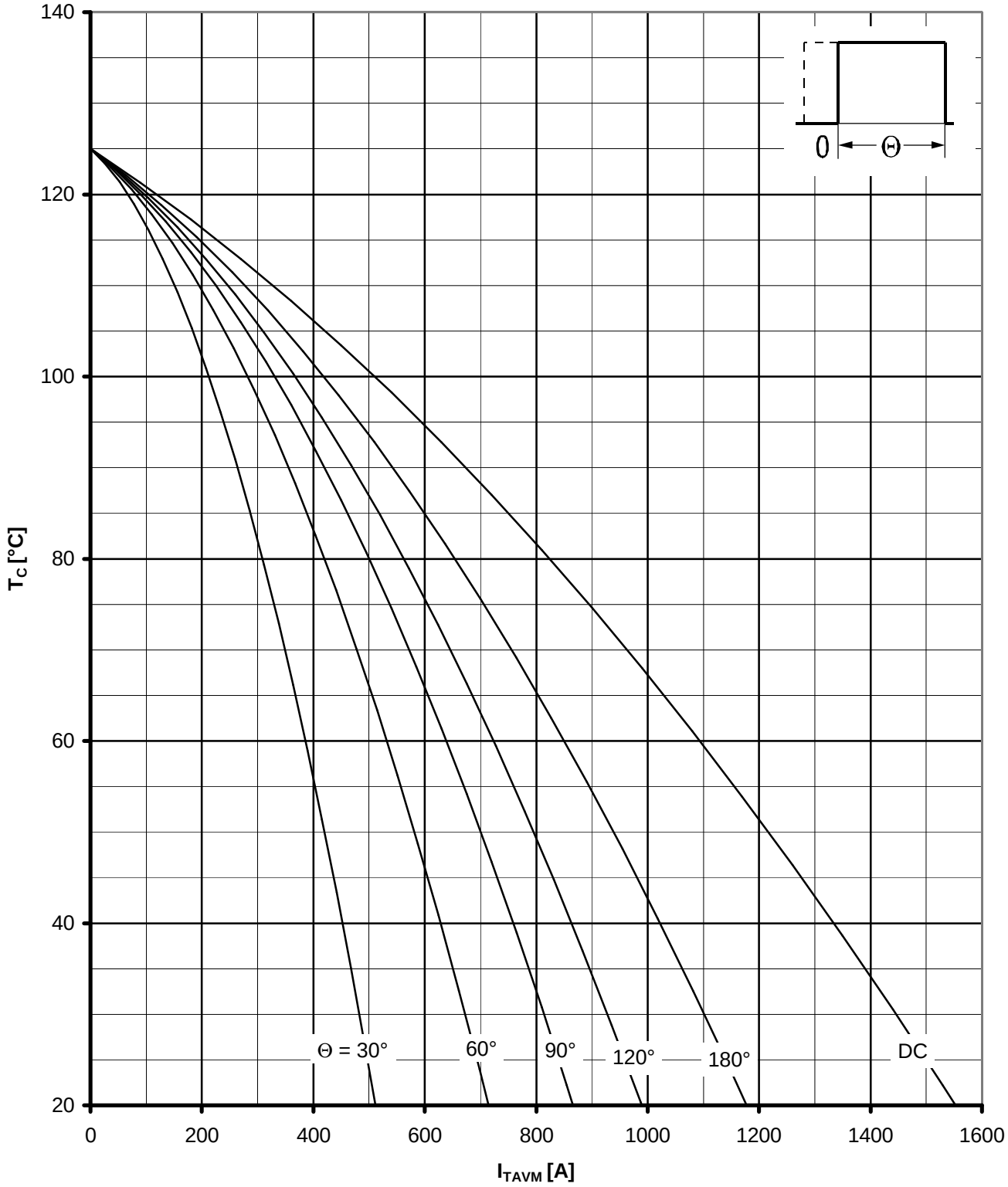
Parameter: Stromflußwinkel Θ / current conduction angle Θ



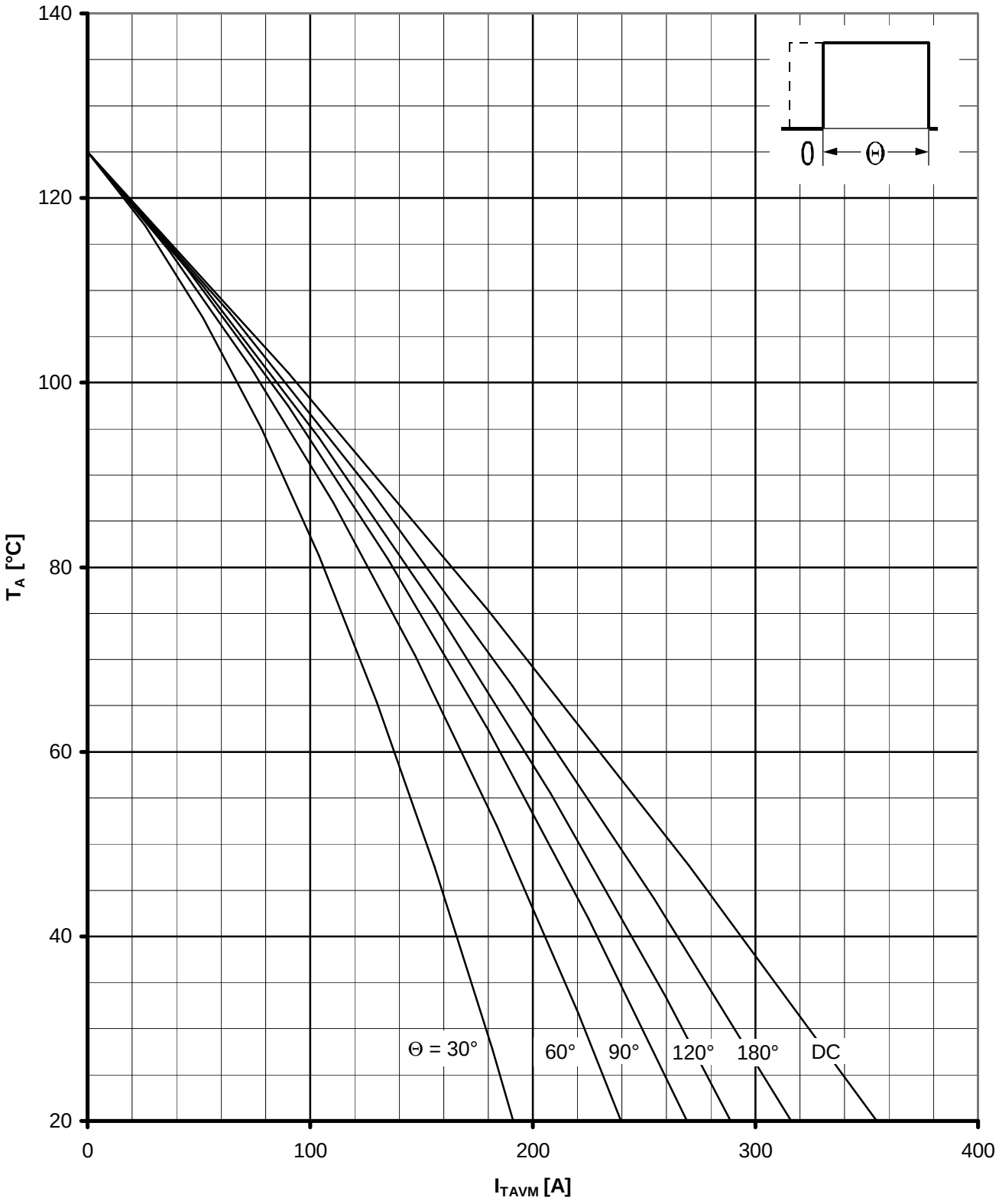

Durchlaßverlustleistung / On-state power loss $P_{TAV} = f(I_{TAV})$
Parameter: Stromflußwinkel Θ / current conduction angle Θ



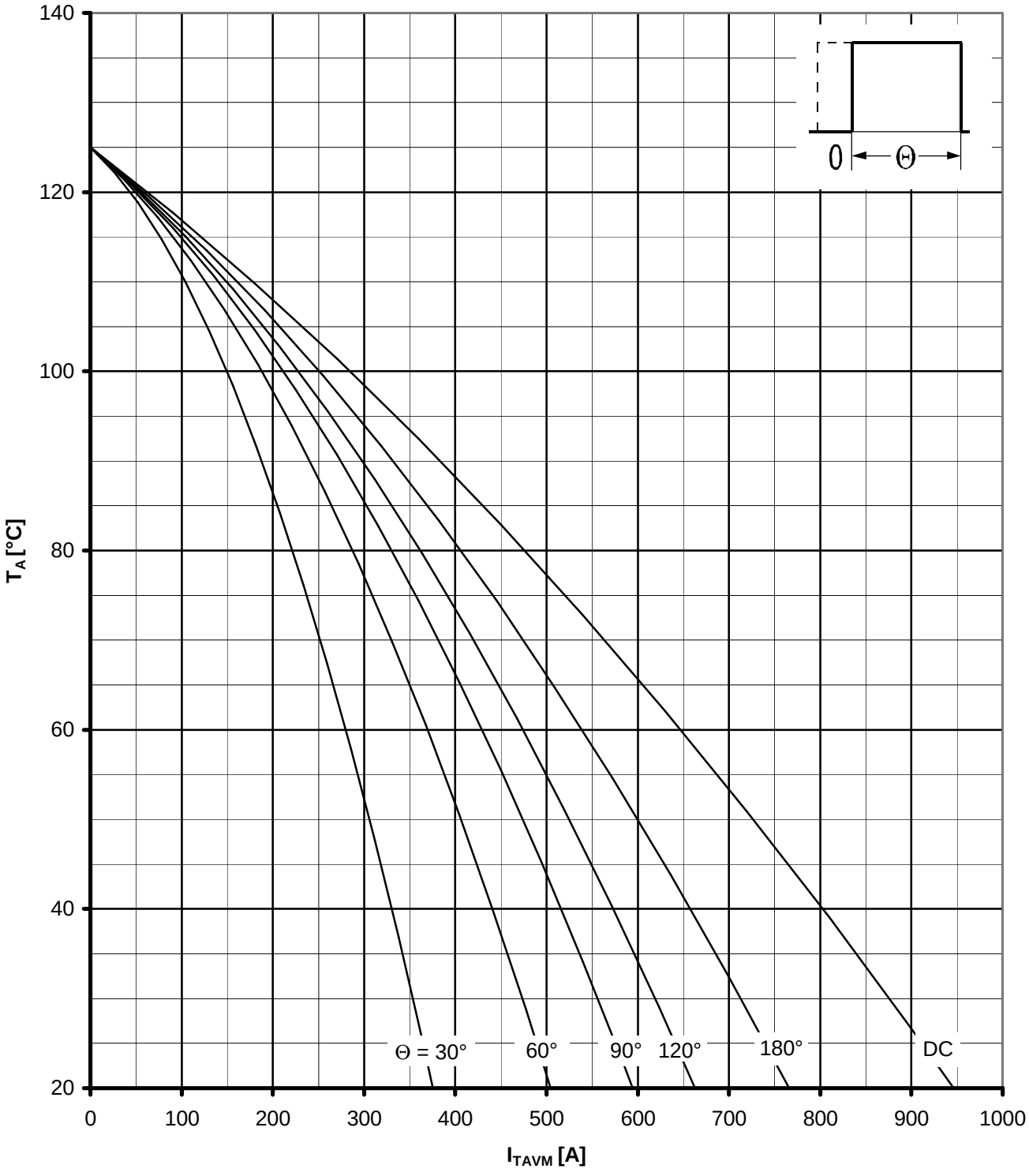

Höchstzulässige Gehäusetemperatur / Maximum allowable case temperature $T_C = f(I_{TAVM})$
Beidseitige Kühlung / Two-sided cooling
Parameter: Stromflußwinkel Θ / current conduction angle Θ



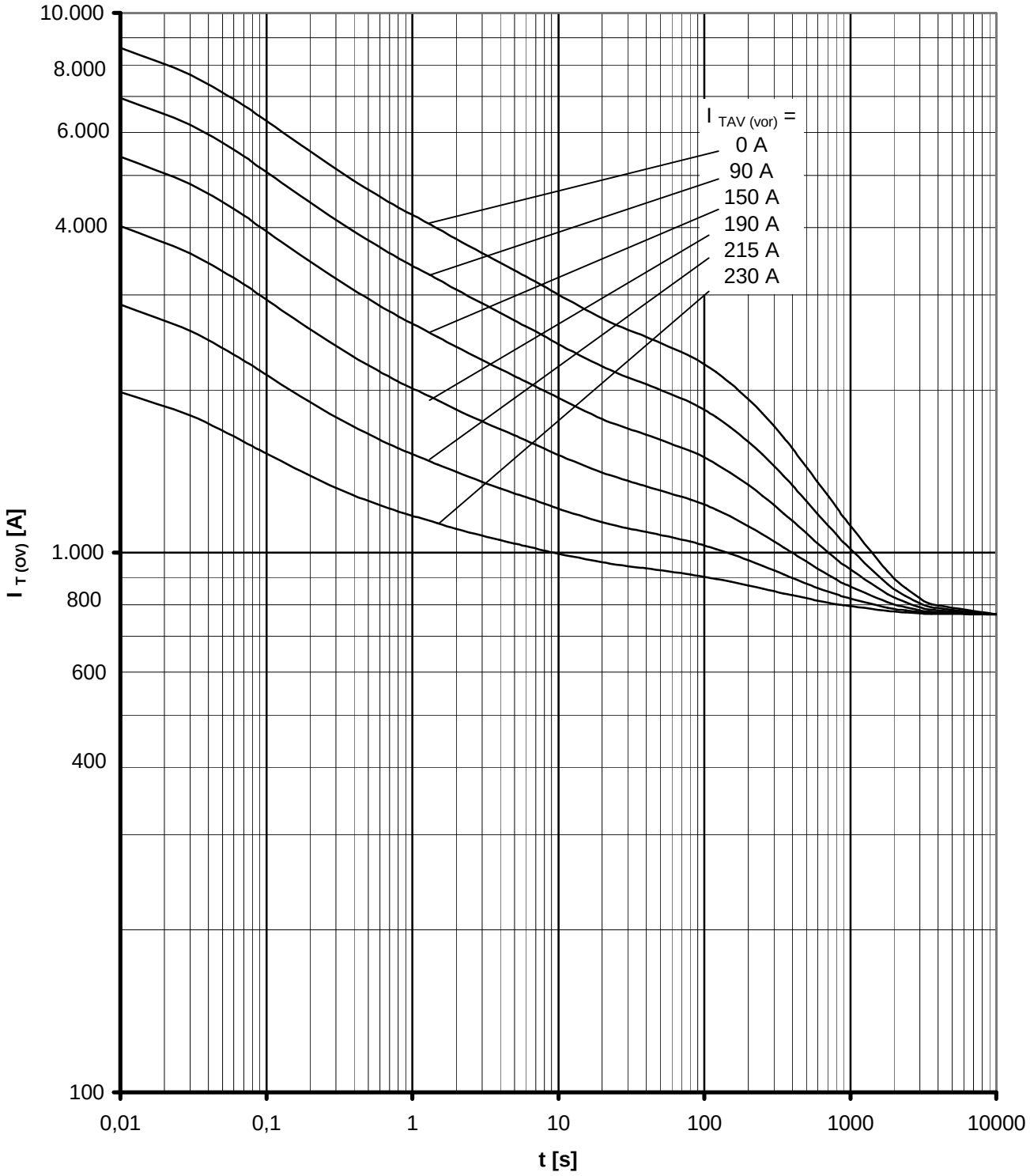

Höchstzulässige Gehäusetemperatur / Maximum allowable case temperature $T_C = f(I_{TAVM})$
Anodenseitige Kühlung / anode sided cooling
Parameter: Stromflußwinkel Θ / current conduction angle Θ




Höchstzulässige Kühlmitteltemperatur / Max. allowable cooling medium temperature $T_A = f(I_{TAVM})$
Luftselbstkühlung / Natural air-cooling
Kühlkörper/Heatsink. K0.05 F
Parameter: Stromflußwinkel Θ / current conduction angle Θ



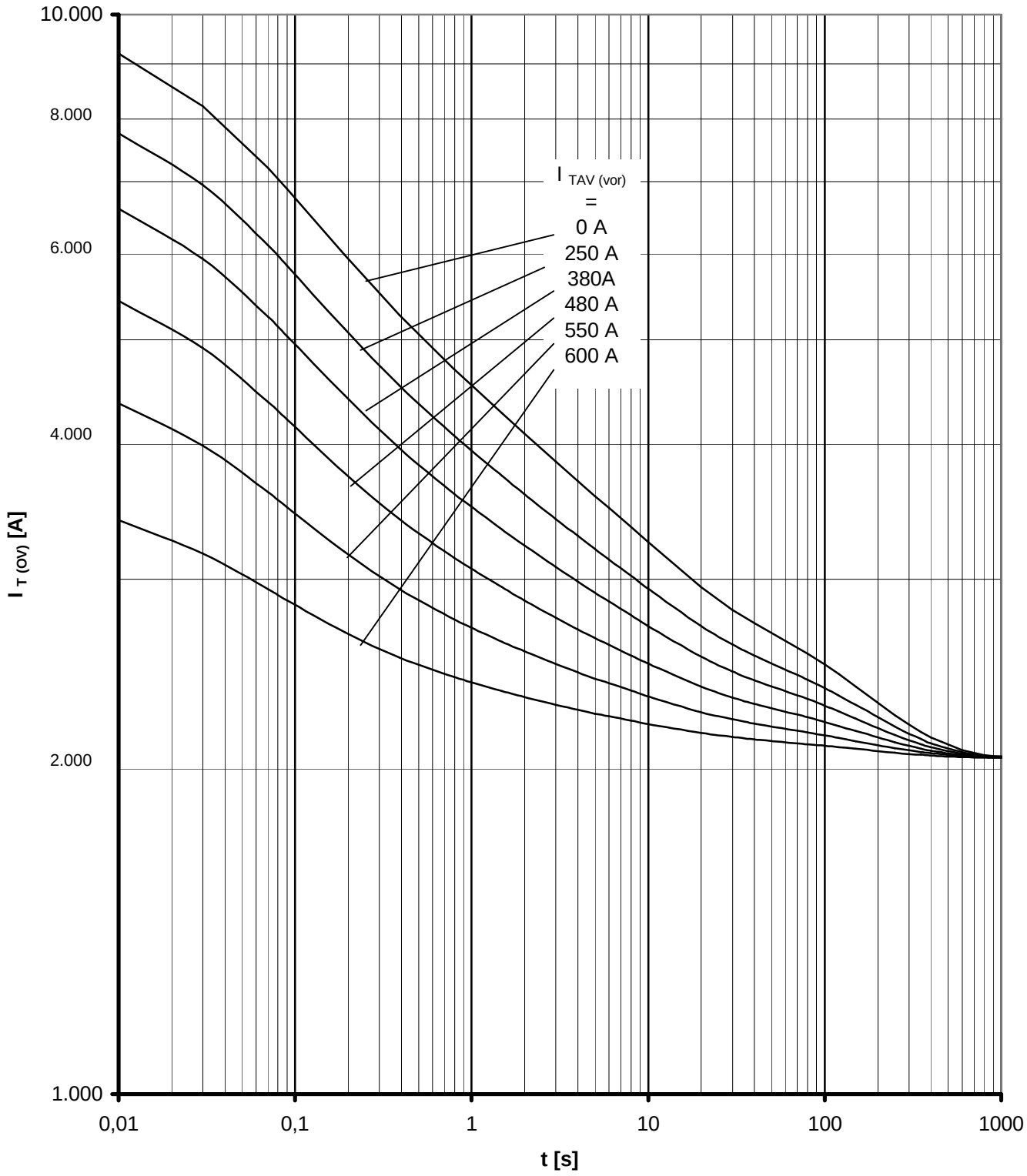

Höchstzulässige Kühlmitteltemperatur / Max. allowable cooling medium temperature $T_A = f(I_{TAVM})$
Verstärkte Luftkühlung / Forced air-cooling
Kühlkörper/Heatsink. K0.05F, $V_L$ = 120 l/s
Parameter: Stromflußwinkel Θ / current conduction angle Θ




Überstrom / Overload on-state current $I_{T(OV)} = f(t)$

Beidseitige Luftselbstkühlung / Two-sided natural cooling K 0.36 S
$T_A$ = 45°C

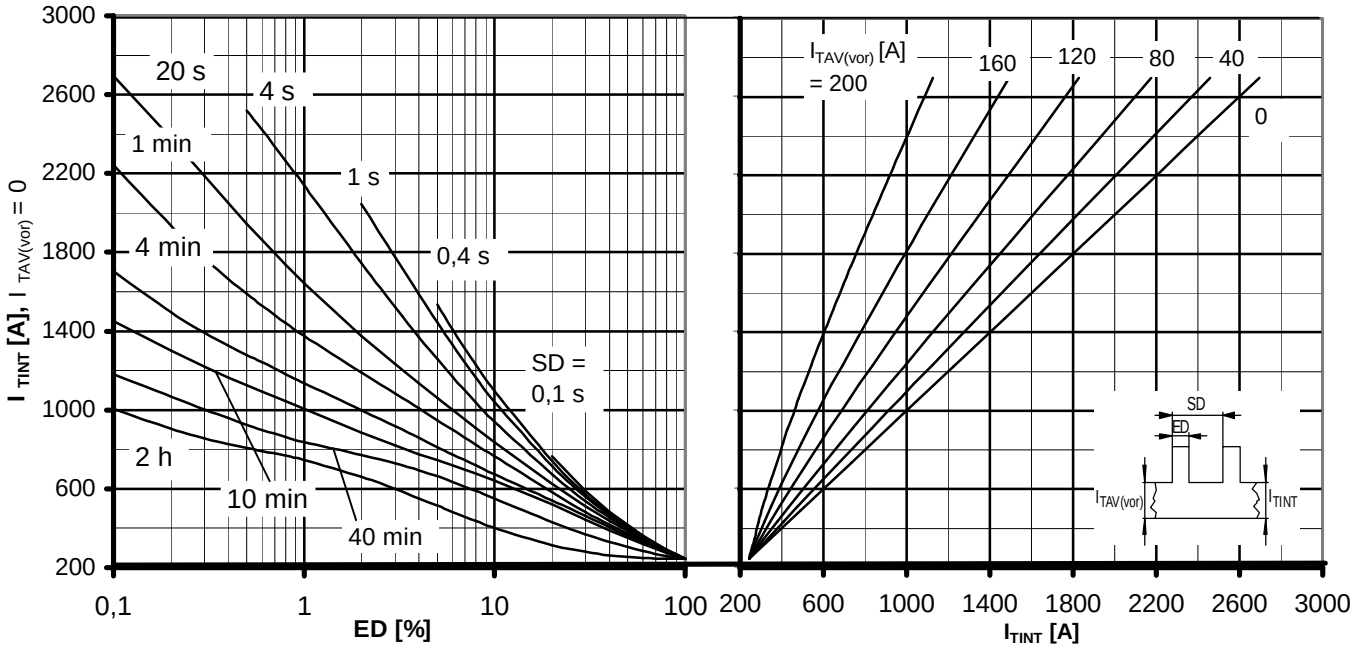
Parameter: Vorlaststrom / pre-load current $I_{TAV(vor)}$




Überstrom / Overload on-state current $I_{T(OV)} = f(t)$

Beidseitige verstärkte Kühlung / forced two-sided cooling K0.05 F
$T_A$ = 35°C, $V_L$ = 120 l/s

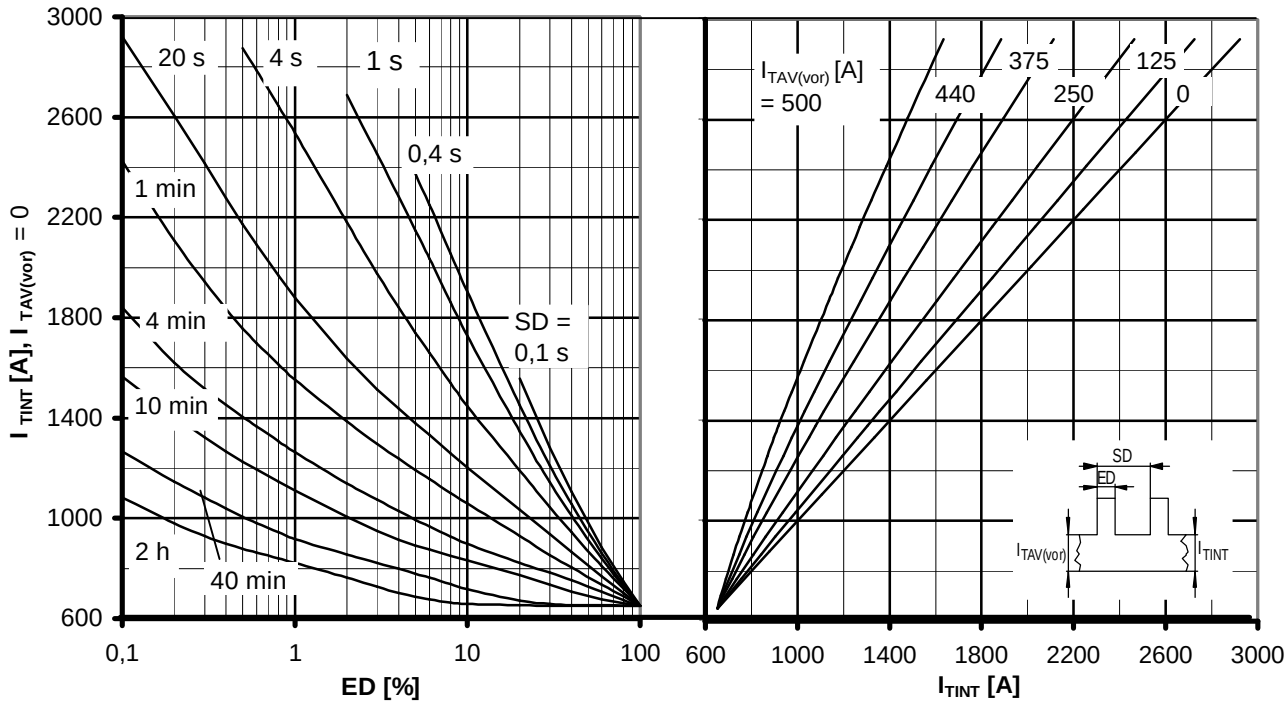
Parameter: Vorlaststrom / pre-load current $I_{TAV(vor)}$




Höchstzul. Durchlaßstrom bei Ausetzbetrieb / Max. allowable on-state current
during intermittent operation $I_{TINT} = f(ED)$

Beidseitig Luftselbstkühlung / two-sided natural cooling K 0.05F
$T_A$ = 45 °C

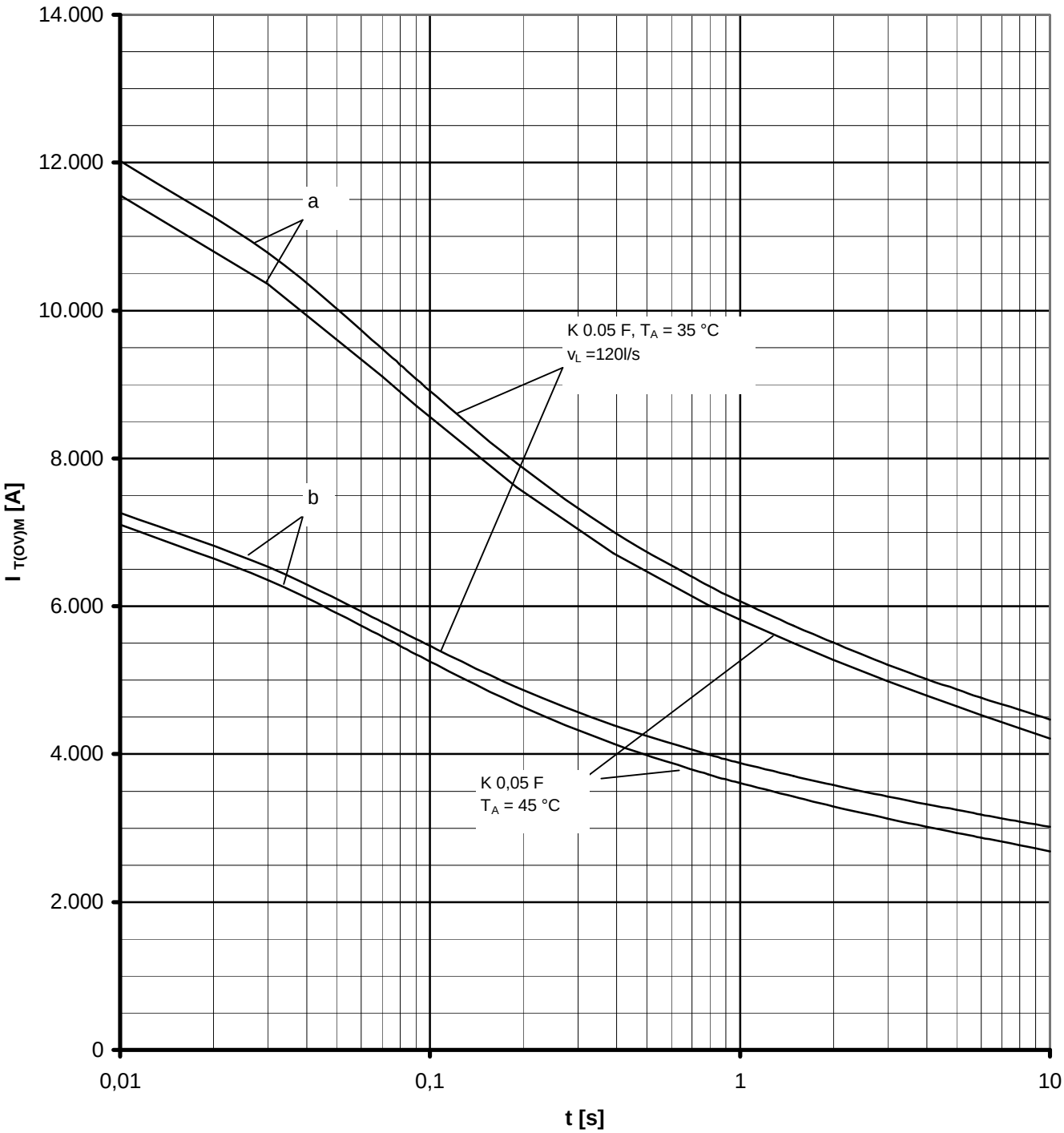
Parameter: Vorlaststrom / pre-load current $I_{TAV(vor)}$ , Spieldauer / cycle duration SD




Höchstzul. Durchlaßstrom bei Ausetzbetrieb / Max. allowable on-state current
during intermittent operation $I_{TINT} = f(ED)$

Beidseitig verstärkte Kühlung / forced two-sided cooling K 0.05F
$T_A$ = 35 °C, $V_L$ = 120 l/s

Parameter: Vorlaststrom / pre-load current $I_{TAV(vor)}$ , Spieldauer / cycle duration SD




Grenzstrom / Max. overload on-state current $I_{T(OV)M} = f(t)$, $v_{RM} = 0{,}8\ V_{RRM}$

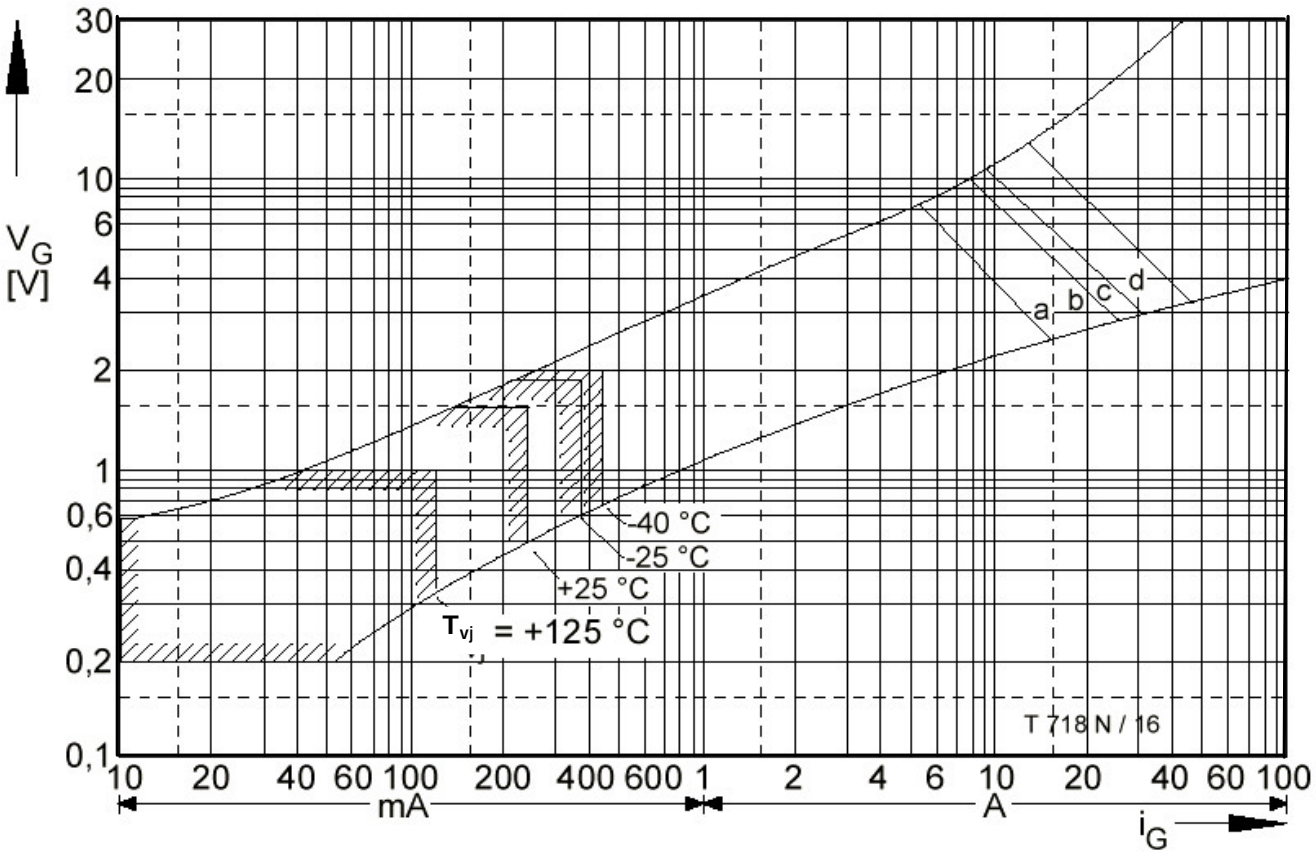
Beidseitige Kühlung / Two-sided cooling

Kühlkörper / Heatsink: K 0.05 F

Belastung aus / Surge current occurs:

a - Leerlauf / No-load conditions

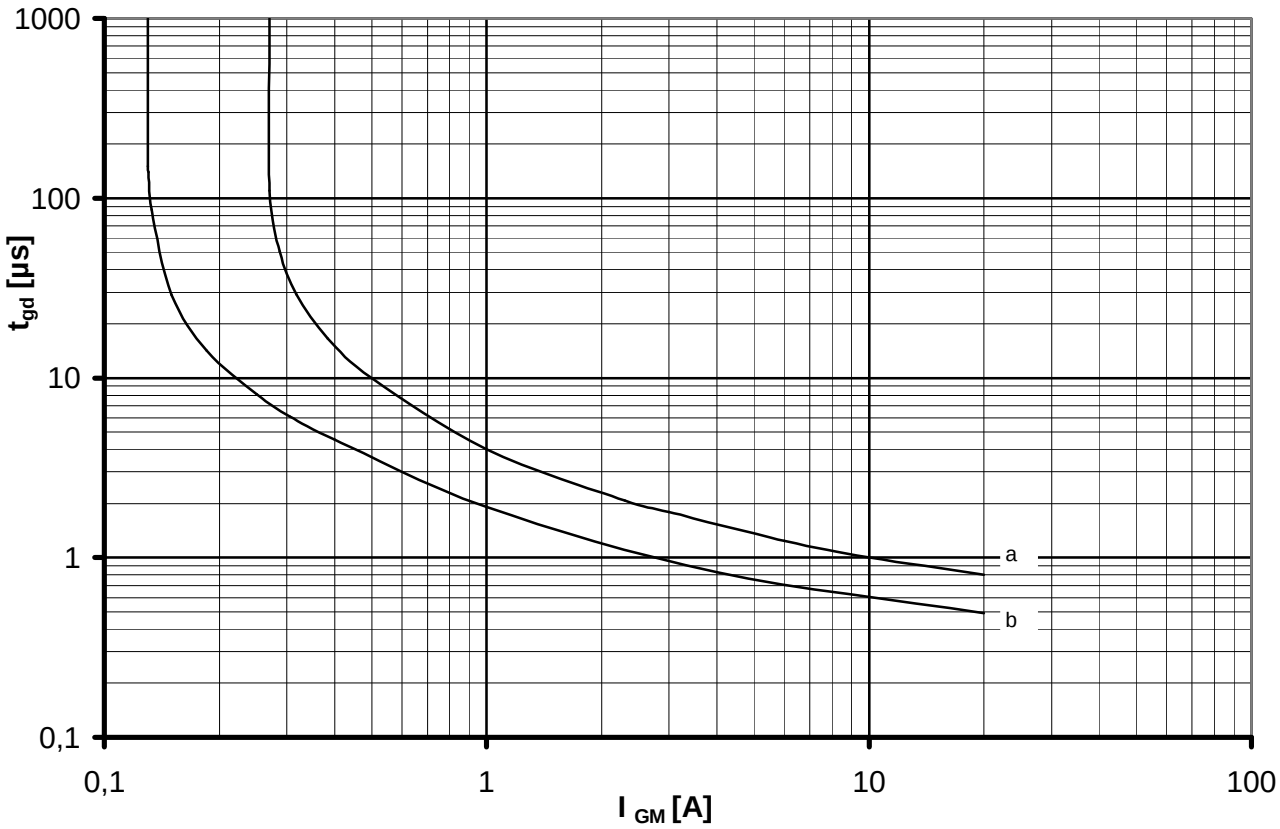
b - Betrieb mit Dauergrenzstrom / During operation at max. average on-state current $I_{TAVM}$




Steuercharakteristik $v_G = f(i_G)$ mit Zündbereichen für $V_D$ = 6 V
Gate characteristic $v_G = f(i_G)$ with triggering area for $V_D$ = 6 V

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

a - 40 W/10ms b - 80 W/1ms c - 100 W/0,5ms d - 150 W/0,1ms

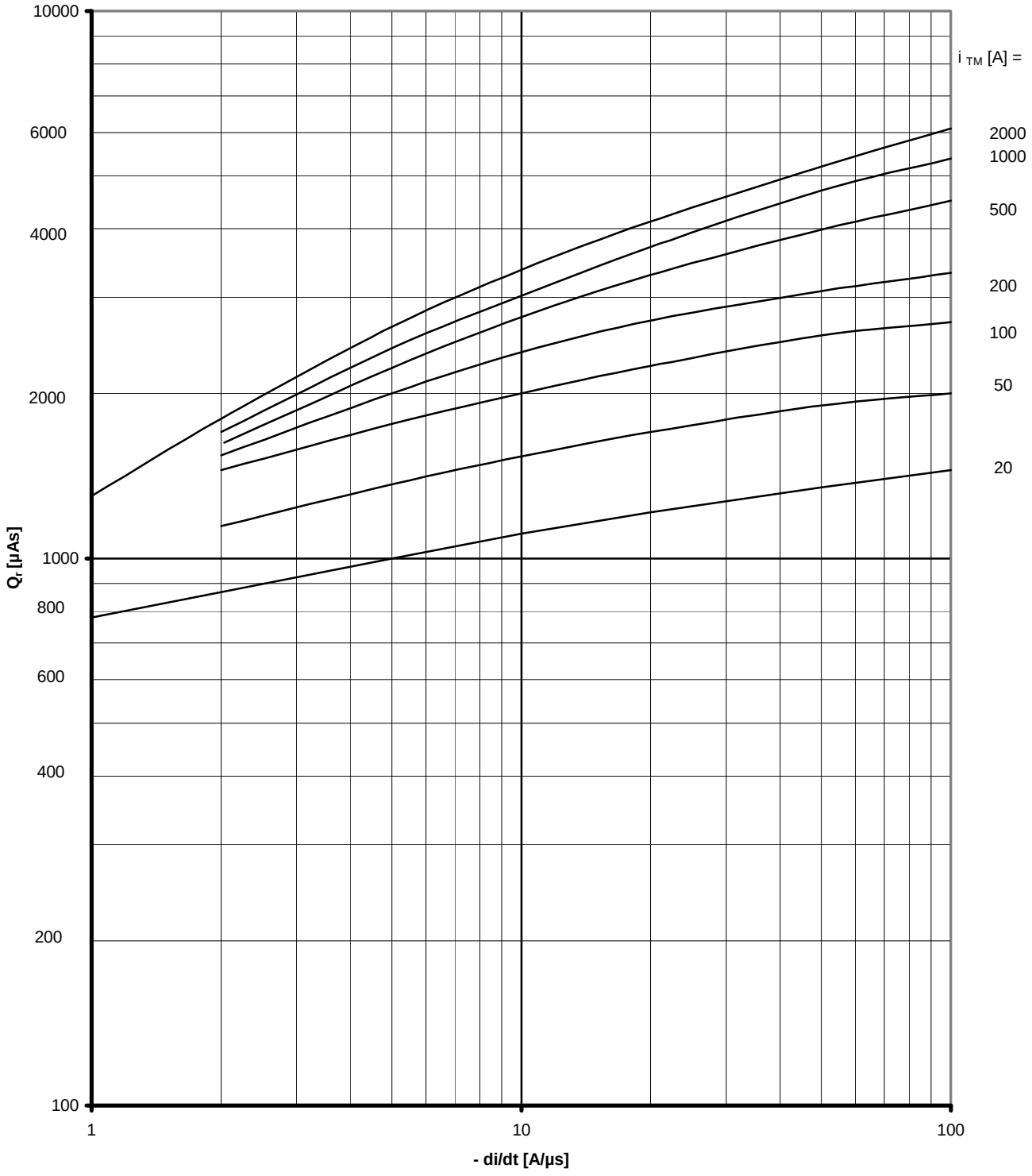



Zündverzug / Gate controlled delay time $t_{gd} = f(i_{GM})$

$T_{vj}$ = 25°C, $di_G/dt = i_{GM}/1\mu s$

a - maximaler Verlauf / limiting characteristic

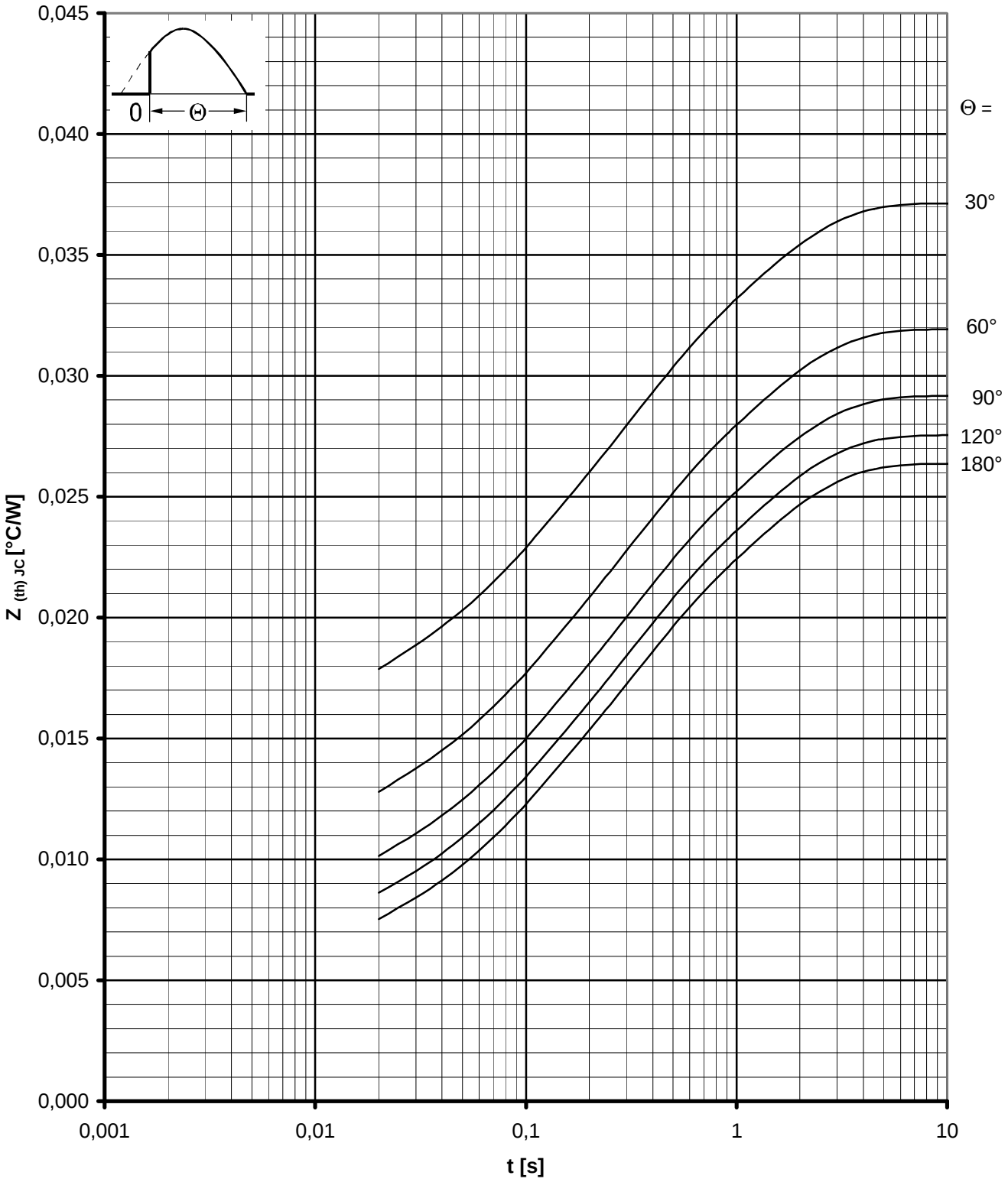
b - typischer Verlauf / typical characteristic




Sperrverzögerungsladung / Recovered charge $Q_r = f(di/dt)$

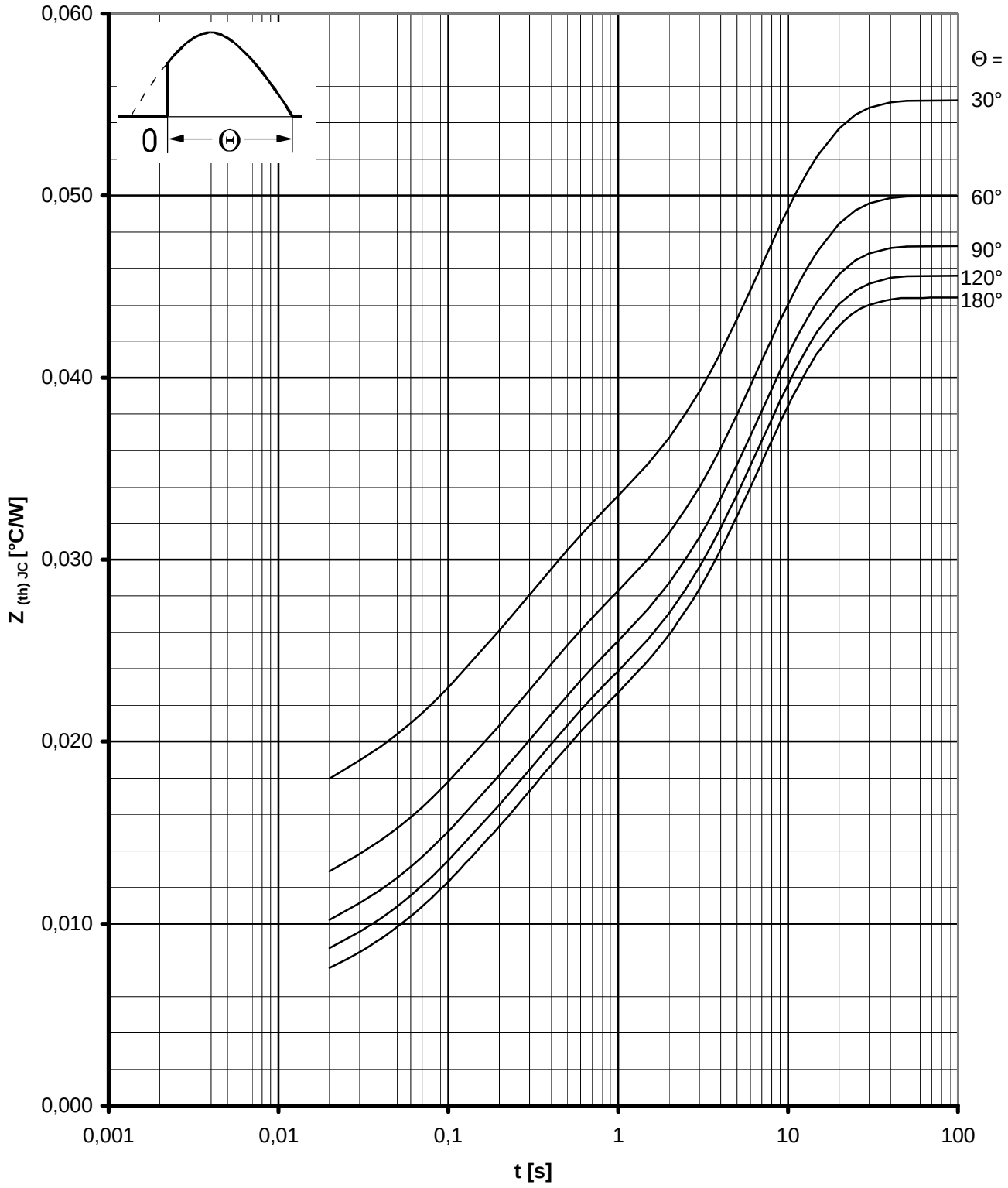
$T_{vj} = T_{vj}$ max, $v_R = 0{,}5\ V_{RRM}$, $v_{RM} = 0{,}8\ V_{RRM}$

Parameter: Durchlaßstrom / On-state current $i_{TM}$

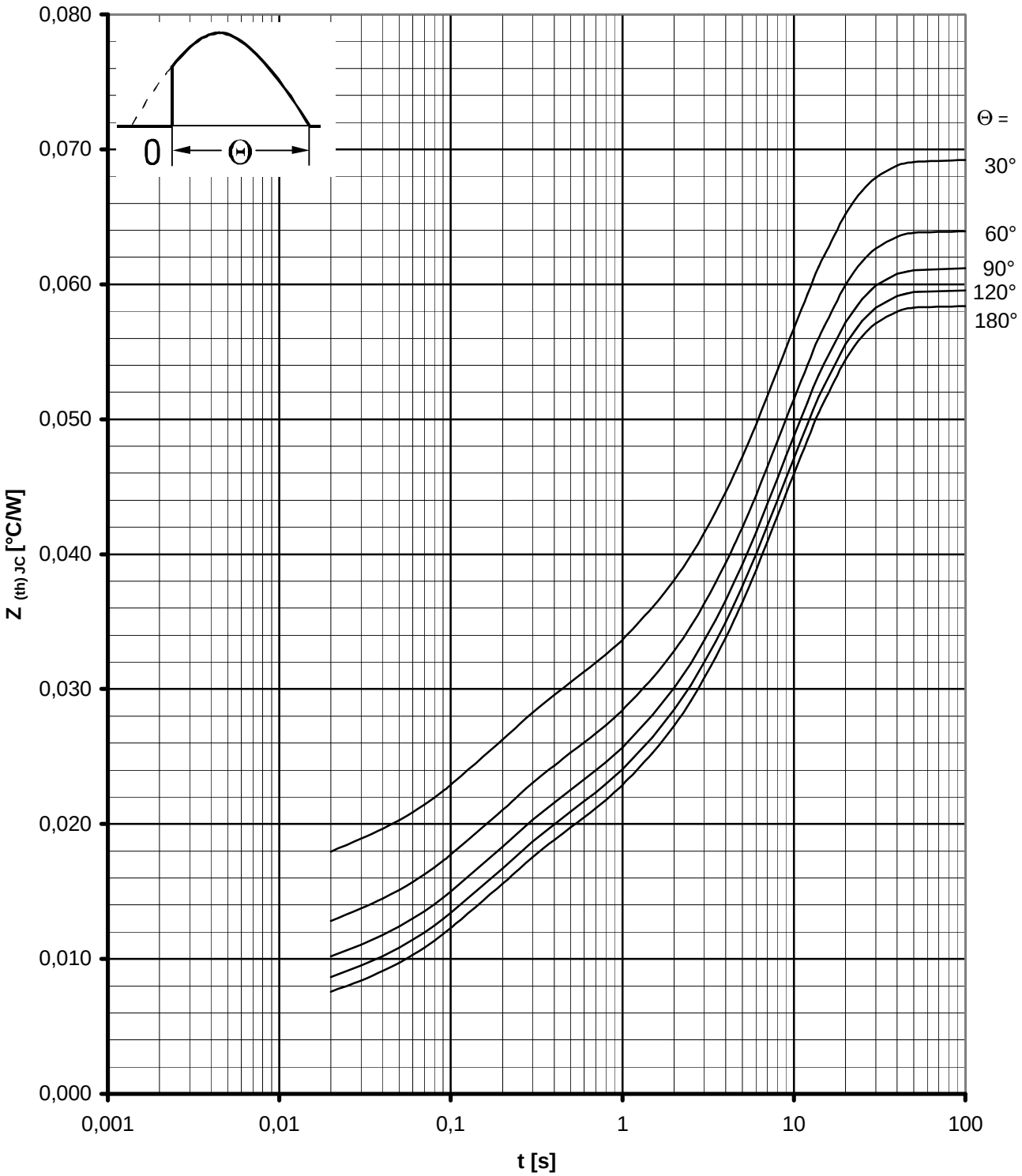



Transienter innerer Wärmewiderstand / Transient thermal impedance $Z_{(th)JC} = f(t)$

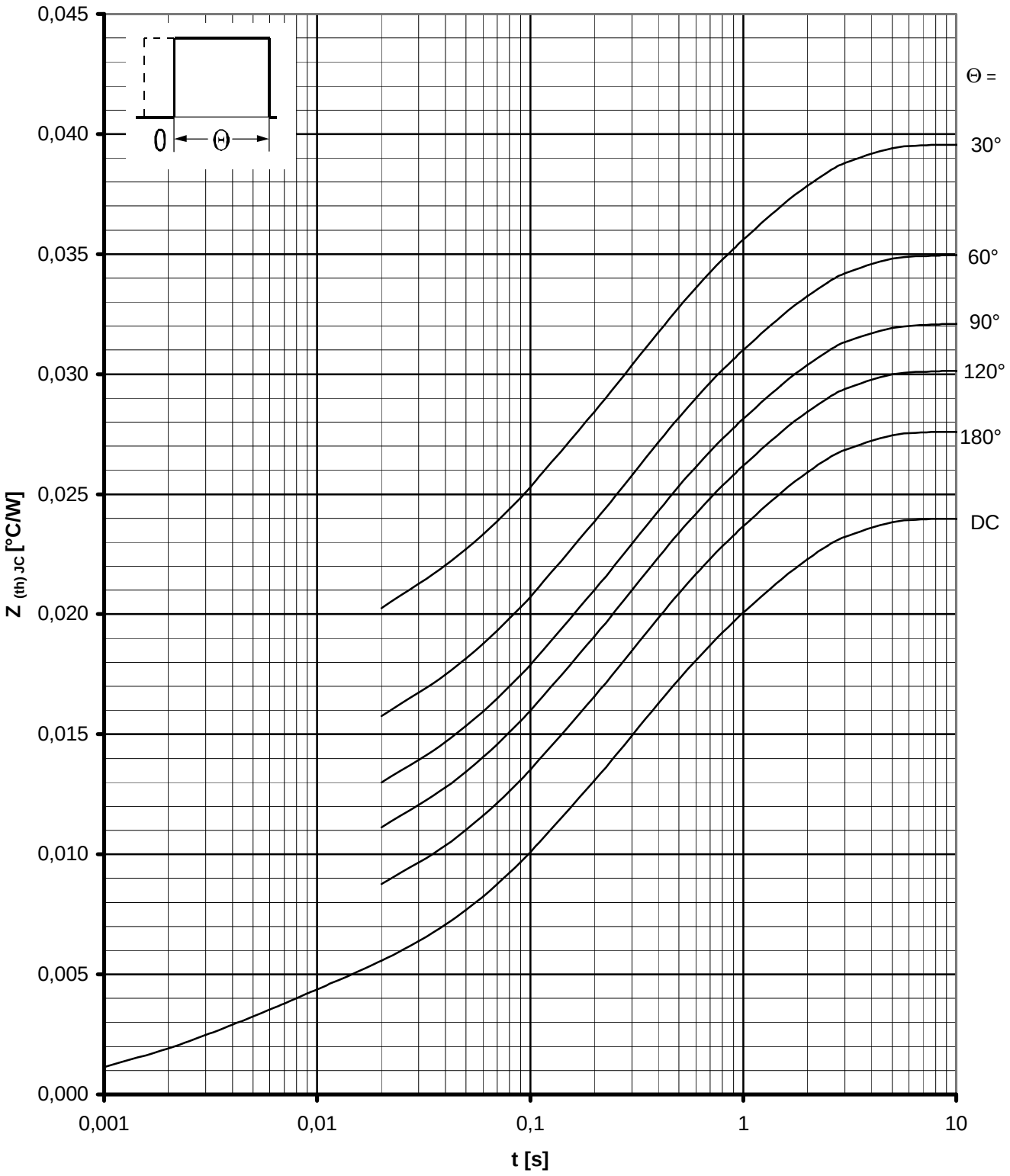
Beidseitige Kühlung /Ttwo-sided cooling
Parameter: Stromflußwinkel Θ / current conduction angle Θ




Transienter innerer Wärmewiderstand / Transient thermal impedance $Z_{(th)JC} = f(t)$
Anodenseitige Kühlung / Anode-sided sided cooling
Parameter: Stromflußwinkel Θ / current conduction angle Θ

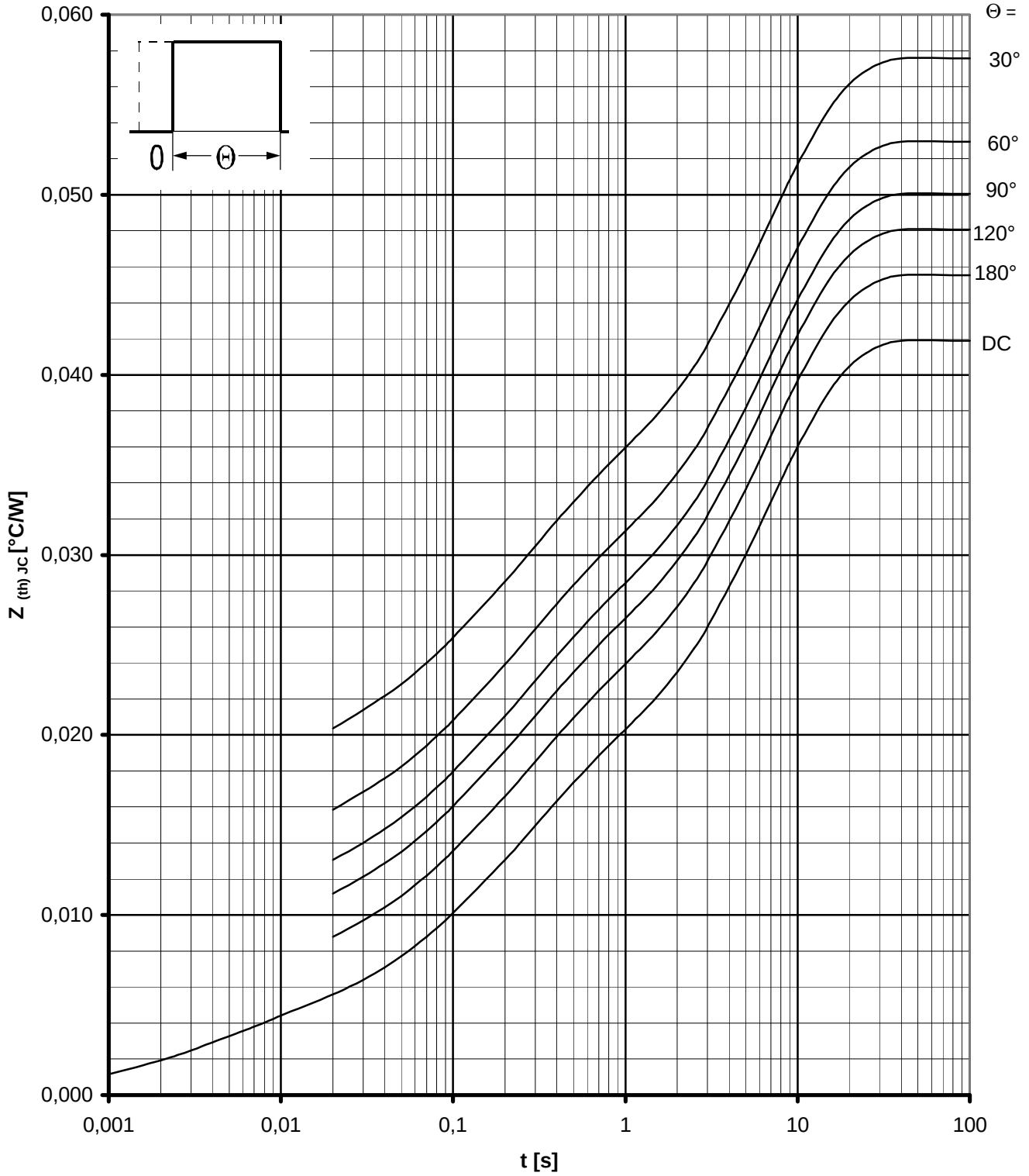



Transienter innerer Wärmewiderstand / Transient thermal impedance $Z_{(th)JC} = f(t)$
Kathodenseitige Kühlung / Cathde-sided cooling
Parameter: Stromflußwinkel Θ / current conduction angle Θ

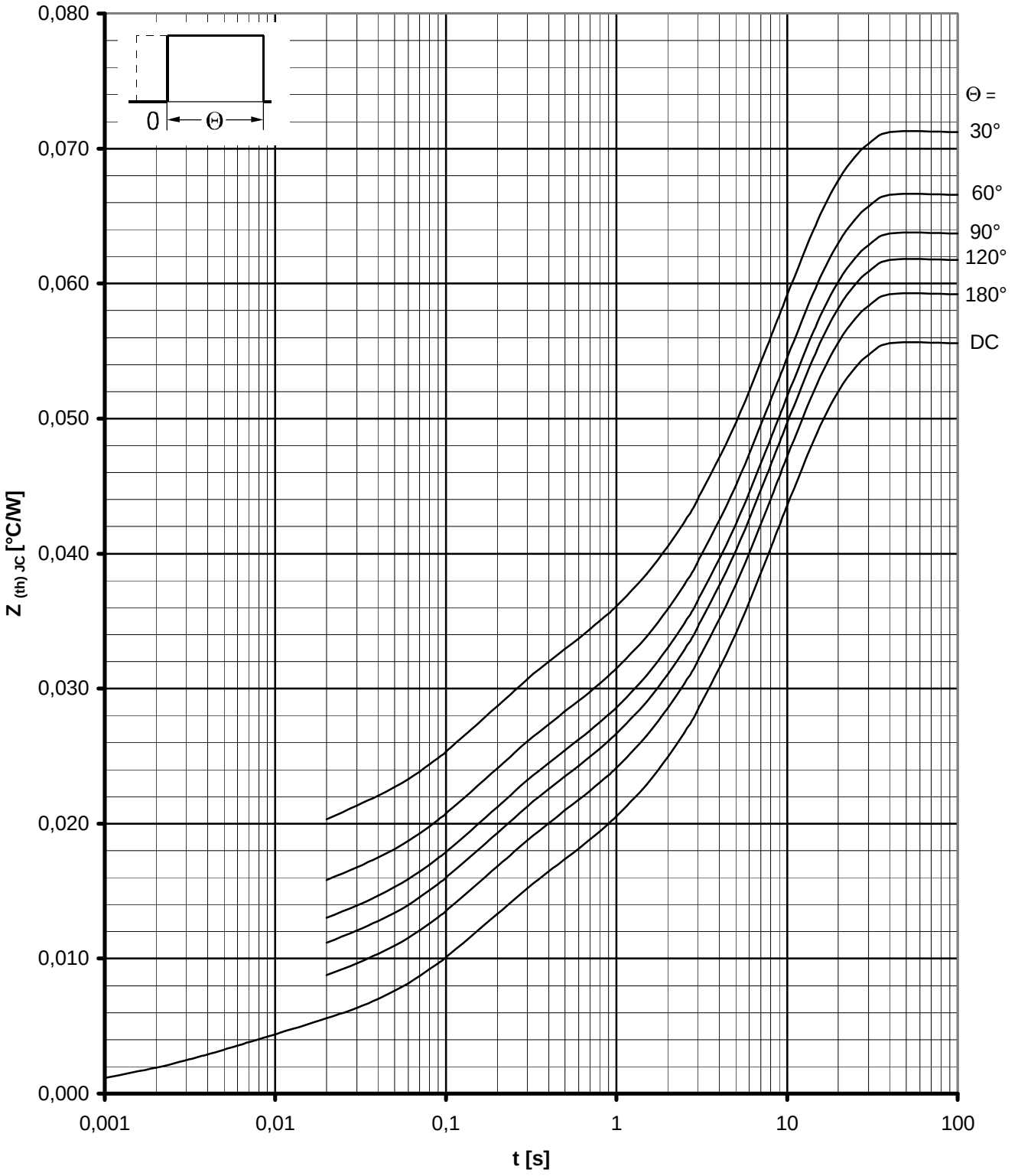



Transienter innerer Wärmewiderstand / Transient thermal impedance $Z_{(th)JC} = f(t)$

Beidseitige Kühlung / Two-sided cooling
Parameter: Stromflußwinkel Θ / current conduction angle Θ




Transienter innerer Wärmewiderstand / Transient thermal impedance $Z_{(th)JC} = f(t)$
Anodenseitige Kühlung / Anode-sided cooling
Parameter: Stromflußwinkel Θ / current conduction angle Θ




Transienter innerer Wärmewiderstand / Transient thermal impedance $Z_{(th)JC} = f(t)$

Kathodenseitige Kühlung / Cathode-sided cooling
Parameter: Stromflußwinkel Θ / current conduction angle Θ