


**Netz-Thyristor-Modul**  
**Phase Control Thyristor Module**
**TZ425N**
**TZ425N**
**Elektrische Eigenschaften / Electrical properties**

Höchstzulässige Werte / Maximum rated values

|                                                                                                                    |                                                                                                               |                                  |              |                   |                                      |
|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|----------------------------------|--------------|-------------------|--------------------------------------|
| Periodische Vorwärts- und Rückwärts-Spitzensperrspannung<br>repetitive peak forward off-state and reverse voltages | $T_{vj} = -40^{\circ}\text{C} \dots T_{vj \max}$                                                              | $V_{\text{DRM}}, V_{\text{RRM}}$ | 1200<br>1600 | 1400<br>1800      | V<br>V <sup>1)</sup>                 |
| Vorwärts-Stoßspitzensperrspannung<br>non-repetitive peak forward off-state voltage                                 | $T_{vj} = -40^{\circ}\text{C} \dots T_{vj \max}$                                                              | $V_{\text{DSM}}$                 | 1200<br>1600 | 1400<br>1800      | V<br>V                               |
| Rückwärts-Stoßspitzensperrspannung<br>non-repetitive peak reverse voltage                                          | $T_{vj} = +25^{\circ}\text{C} \dots T_{vj \max}$                                                              | $V_{\text{RSM}}$                 | 1300<br>1700 | 1500<br>1900      | V<br>V                               |
| Durchlaßstrom-Grenzeffektivwert<br>maximum RMS on-state current                                                    |                                                                                                               | $I_{\text{TRMSM}}$               |              | 800               | A                                    |
| Dauergrenzstrom<br>average on-state current                                                                        | $T_{\text{C}} = 85^{\circ}\text{C}$<br>$T_{\text{C}} = 74^{\circ}\text{C}$                                    | $I_{\text{TAVM}}$                |              | 425<br>510        | A<br>A                               |
| Stoßstrom-Grenzwert<br>surge current                                                                               | $T_{vj} = 25^{\circ}\text{C}, t_p = 10 \text{ ms}$<br>$T_{vj} = T_{vj \max}, t_p = 10 \text{ ms}$             | $I_{\text{TSM}}$                 |              | 14500<br>12500    | A<br>A                               |
| Grenzlastintegral<br>$I^2t$ -value                                                                                 | $T_{vj} = 25^{\circ}\text{C}, t_p = 10 \text{ ms}$<br>$T_{vj} = T_{vj \max}, t_p = 10 \text{ ms}$             | $I^2t$                           |              | 1051000<br>781000 | A <sup>2</sup> s<br>A <sup>2</sup> s |
| Kritische Stromsteilheit<br>critical rate of rise of on-state current                                              | DIN IEC 747-6<br>$f = 50 \text{ Hz}, i_{\text{GM}} = 1 \text{ A}, di_{\text{G}}/dt = 1 \text{ A}/\mu\text{s}$ | $(di_{\text{T}}/dt)_{\text{cr}}$ |              | 120               | A/ $\mu\text{s}$                     |
| Kritische Spannungssteilheit<br>critical rate of rise of off-state voltage                                         | $T_{vj} = T_{vj \max}, V_{\text{D}} = 0,67 V_{\text{DRM}}$<br>6.Kennbuchstabe / 6 <sup>th</sup> letter F      | $(dv_{\text{D}}/dt)_{\text{cr}}$ |              | 1000              | V/ $\mu\text{s}$                     |

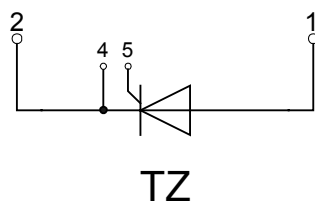
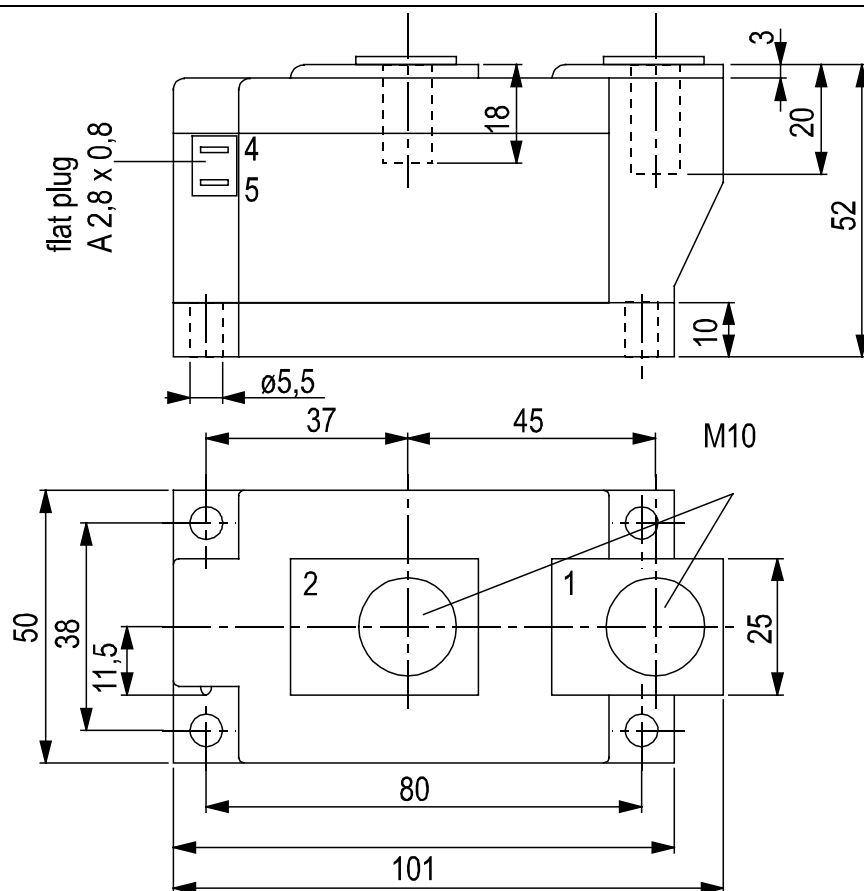
**Charakteristische Werte / Characteristic values**

|                                                                             |                                                                                                                                                                                                     |                              |              |         |               |
|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------|---------|---------------|
| Durchlaßspannung<br>on-state voltage                                        | $T_{vj} = T_{vj \max}, i_{\text{T}} = 1500 \text{ A}$                                                                                                                                               | $v_{\text{T}}$               | max.         | 1,50    | V             |
| Schleusenspannung<br>threshold voltage                                      | $T_{vj} = T_{vj \max}$                                                                                                                                                                              | $V_{(\text{TO})}$            |              | 0,9     | V             |
| Ersatzwiderstand<br>slope resistance                                        | $T_{vj} = T_{vj \max}$                                                                                                                                                                              | $r_{\text{T}}$               |              | 0,3     | m $\Omega$    |
| Zündstrom<br>gate trigger current                                           | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6 \text{ V}$                                                                                                                                           | $I_{\text{GT}}$              | max.         | 250     | mA            |
| Zündspannung<br>gate trigger voltage                                        | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6 \text{ V}$                                                                                                                                           | $V_{\text{GT}}$              | max.         | 1,5     | V             |
| Nicht zündender Steuerstrom<br>gate non-trigger current                     | $T_{vj} = T_{vj \max}, V_{\text{D}} = 6 \text{ V}$<br>$T_{vj} = T_{vj \max}, V_{\text{D}} = 0,5 V_{\text{DRM}}$                                                                                     | $I_{\text{GD}}$              | max.<br>max. | 10<br>5 | mA<br>mA      |
| Nicht zündende Steuerspannung<br>gate non-trigger voltage                   | $T_{vj} = T_{vj \max}, V_{\text{D}} = 0,5 V_{\text{DRM}}$                                                                                                                                           | $V_{\text{GD}}$              | max.         | 0,2     | V             |
| Haltestrom<br>holding current                                               | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6 \text{ V}, R_{\text{A}} = 5 \Omega$                                                                                                                  | $I_{\text{H}}$               | max.         | 300     | mA            |
| Einraststrom<br>latching current                                            | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6 \text{ V}, R_{\text{GK}} \geq 10 \Omega$<br>$i_{\text{GM}} = 1 \text{ A}, di_{\text{G}}/dt = 1 \text{ A}/\mu\text{s}, t_{\text{g}} = 20 \mu\text{s}$ | $I_{\text{L}}$               | max.         | 1500    | mA            |
| Vorwärts- und Rückwärts-Sperrstrom<br>forward off-state and reverse current | $T_{vj} = T_{vj \max}$<br>$V_{\text{D}} = V_{\text{DRM}}, V_{\text{R}} = V_{\text{RRM}}$                                                                                                            | $i_{\text{D}}, i_{\text{R}}$ | max.         | 80      | mA            |
| Zündverzug<br>gate controlled delay time                                    | DIN IEC 747-6<br>$T_{vj} = 25^{\circ}\text{C}, i_{\text{GM}} = 1 \text{ A}, di_{\text{G}}/dt = 1 \text{ A}/\mu\text{s}$                                                                             | $t_{\text{gd}}$              | max.         | 4       | $\mu\text{s}$ |

<sup>1)</sup> 1800 auf Anfrage/ 1800V on request

|              |            |                      |          |
|--------------|------------|----------------------|----------|
| prepared by: | C.Drilling | date of publication: | 29.08.02 |
| approved by: | J. Novotny | revision:            | 2        |

|                                                                                                                                                                                                                                                                                                                                       |                                                                                   |                                                                                                                                                                                                                     |                   |                            |                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------------|--------------------------------------------------------|
| N                                                                                                                                                                                                                                                                                                                                     |  | Datenblatt / Data sheet                                                                                                                                                                                             |                   | eupec                      |                                                        |
| Netz-Thyristor-Modul<br>Phase Control Thyristor Module                                                                                                                                                                                                                                                                                |                                                                                   | TZ425N                                                                                                                                                                                                              |                   |                            |                                                        |
| Elektrische Eigenschaften / Electrical properties<br>Charakteristische Werte / Characteristic values                                                                                                                                                                                                                                  |                                                                                   |                                                                                                                                                                                                                     |                   |                            |                                                        |
| Freiwerdezeit<br>circuit commutated turn-off time                                                                                                                                                                                                                                                                                     |                                                                                   | $T_{vj} = T_{vj\max}, i_{TM} = I_{TAVM}$<br>$V_{RM} = 100\text{ V}, v_{DM} = 0,67 V_{DRM}$<br>$dv_D/dt = 20\text{ V}/\mu\text{s}, -di_T/dt = 10\text{ A}/\mu\text{s}$<br>5.Kennbuchstabe / 5 <sup>th</sup> letter O |                   | $t_q$                      | typ. 250 $\mu\text{s}$                                 |
| Isolations-Prüfspannung<br>insulation test voltage                                                                                                                                                                                                                                                                                    |                                                                                   | RMS, f = 50 Hz, t = 1 min<br>RMS, f = 50 Hz, t = 1 sec                                                                                                                                                              |                   | $V_{ISOL}$                 | 3,0 kV<br>3,6 kV                                       |
| Thermische Eigenschaften / Thermal properties                                                                                                                                                                                                                                                                                         |                                                                                   |                                                                                                                                                                                                                     |                   |                            |                                                        |
| Innerer Wärmewiderstand<br>thermal resistance, junction to case                                                                                                                                                                                                                                                                       |                                                                                   | pro Modul / per Module, $\Theta = 180^\circ \sin$<br>pro Modul / per Module, DC                                                                                                                                     | $R_{thJC}$        | max. 0,0780<br>max. 0,0745 | $^\circ\text{C}/\text{W}$<br>$^\circ\text{C}/\text{W}$ |
| Übergangs-Wärmewiderstand<br>thermal resistance, case to heatsink                                                                                                                                                                                                                                                                     |                                                                                   | pro Modul / per Module                                                                                                                                                                                              | $R_{thCH}$        | max. 0,02                  | $^\circ\text{C}/\text{W}$                              |
| Höchstzulässige Sperrschichttemperatur<br>maximum junction temperature                                                                                                                                                                                                                                                                |                                                                                   |                                                                                                                                                                                                                     | $T_{vj\max}$      | 125                        | $^\circ\text{C}$                                       |
| Betriebstemperatur<br>operating temperature                                                                                                                                                                                                                                                                                           |                                                                                   |                                                                                                                                                                                                                     | $T_{c\text{ op}}$ | -40...+125                 | $^\circ\text{C}$                                       |
| Lagertemperatur<br>storage temperature                                                                                                                                                                                                                                                                                                |                                                                                   |                                                                                                                                                                                                                     | $T_{stg}$         | -40...+130                 | $^\circ\text{C}$                                       |
| Mechanische Eigenschaften / Mechanical properties                                                                                                                                                                                                                                                                                     |                                                                                   |                                                                                                                                                                                                                     |                   |                            |                                                        |
| Gehäuse, siehe Anlage<br>case, see annex                                                                                                                                                                                                                                                                                              |                                                                                   |                                                                                                                                                                                                                     |                   | Seite 3<br>page 3          |                                                        |
| Si-Element mit Druckkontakt<br>Si-pellet with pressure contact                                                                                                                                                                                                                                                                        |                                                                                   |                                                                                                                                                                                                                     |                   |                            |                                                        |
| Innere Isolation<br>internal insulation                                                                                                                                                                                                                                                                                               |                                                                                   |                                                                                                                                                                                                                     |                   | AIN                        |                                                        |
| Anzugsdrehmoment für mechanische Anschlüsse<br>mounting torque                                                                                                                                                                                                                                                                        |                                                                                   | Toleranz / Tolerance $\pm 15\%$                                                                                                                                                                                     | M1                | 5                          | Nm                                                     |
| Anzugsdrehmoment für elektrische Anschlüsse<br>terminal connection torque                                                                                                                                                                                                                                                             |                                                                                   | Toleranz / Tolerance + 10% / - 10%                                                                                                                                                                                  | M2                | 12                         | Nm                                                     |
| Steueranschlüsse<br>control terminals                                                                                                                                                                                                                                                                                                 |                                                                                   | DIN 46 244                                                                                                                                                                                                          |                   | A 2,8 x 0,8                |                                                        |
| Gewicht<br>weight                                                                                                                                                                                                                                                                                                                     |                                                                                   |                                                                                                                                                                                                                     | G                 | typ. 900                   | g                                                      |
| Kriechstrecke<br>creepage distance                                                                                                                                                                                                                                                                                                    |                                                                                   |                                                                                                                                                                                                                     |                   | 15                         | mm                                                     |
| Schwingfestigkeit<br>vibration resistance                                                                                                                                                                                                                                                                                             |                                                                                   | f = 50 Hz                                                                                                                                                                                                           |                   | 50                         | m/s <sup>2</sup>                                       |
|                                                                                                                                                                                                                                                    |                                                                                   | file-No.                                                                                                                                                                                                            |                   | E 83336                    |                                                        |
| Mit diesem Datenblatt werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert. Es gilt in Verbindung mit den zugehörigen technischen Erläuterungen.<br><br>This data sheet specifies semiconductor devices, but promises no characteristics. It is valid in combination with the belonging technical notes. |                                                                                   |                                                                                                                                                                                                                     |                   |                            |                                                        |
| BIP AC / MA3-BE / 25 Mar 1992, K.Spec                                                                                                                                                                                                                                                                                                 |                                                                                   | A 3 /92                                                                                                                                                                                                             |                   | Seite/page                 | 2/12                                                   |





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**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 |
|------------------|----------|---------|---------|--------|--------|---|---|
| $R_{thn}$ [°C/W] | 0,00194  | 0,00584 | 0,01465 | 0,0254 | 0,0267 |   |   |
| $\tau_n$ [s]     | 0,000732 | 0,00824 | 0,108   | 0,57   | 3      |   |   |

Analytische Funktion / Analytical function:

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

Luftselbstkühlung / Natural cooling  
3 Module pro Kühlkörper / 3 modules per heatsink  
Kühlkörper / Heatsink type: KM17 (90W)

**Analytische Elemente des transienten Wärmewiderstandes  $Z_{thCA}$**   
**Analytical elements of transient thermal impedance  $Z_{thCA}$**

| Pos. n           | 1     | 2     | 3     | 4 | 5 | 6 | 7 |
|------------------|-------|-------|-------|---|---|---|---|
| $R_{thn}$ [°C/W] | 0,796 | 0,005 | 0,041 |   |   |   |   |
| $\tau_n$ [s]     | 1420  | 912   | 12    |   |   |   |   |

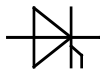
Verstärkte Kühlung / Forced cooling  
3 Module pro Kühlkörper / 3 modules per heatsink  
Kühlkörper / Heatsink type: KM17 (Papst 4650N)

**Analytische Elemente des transienten Wärmewiderstandes  $Z_{thCA}$**   
**Analytical elements of transient thermal impedance  $Z_{thCA}$**

| Pos. n           | 1     | 2      | 3      | 4 | 5 | 6 | 7 |
|------------------|-------|--------|--------|---|---|---|---|
| $R_{thn}$ [°C/W] | 0,239 | 0,0435 | 0,0075 |   |   |   |   |
| $\tau_n$ [s]     | 497   | 31,8   | 6,4    |   |   |   |   |

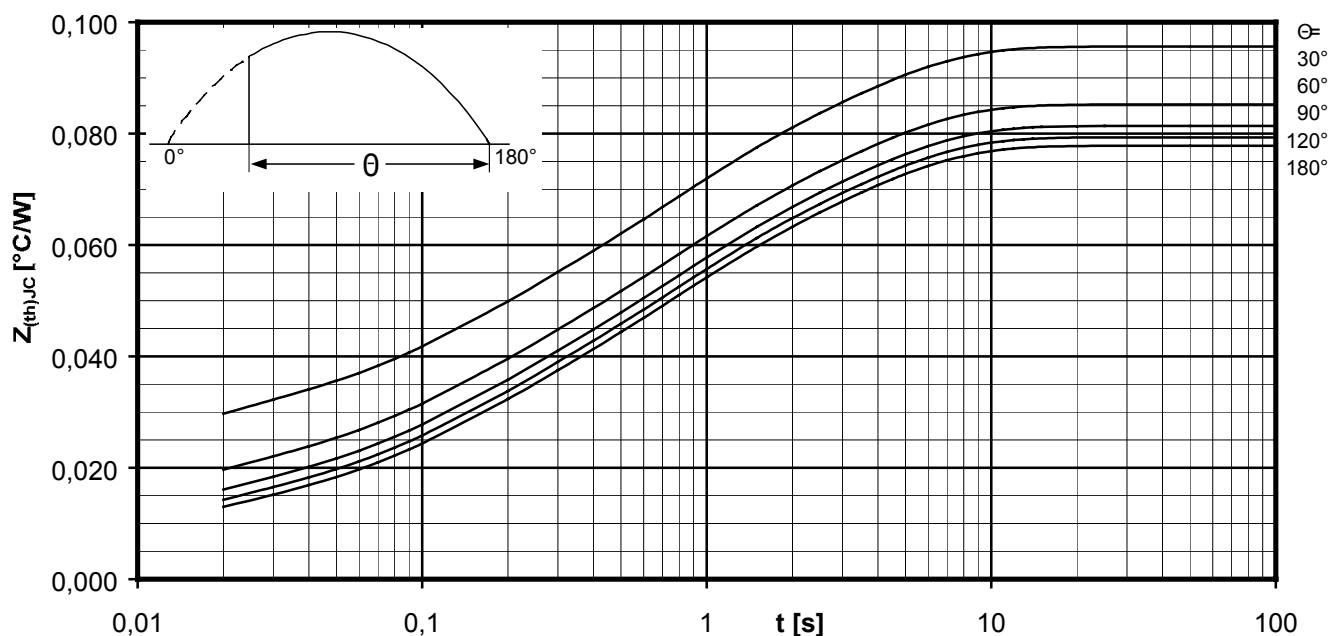
Analytische Funktion / Analytical function:

$$Z_{thCA} = \sum_{n=1}^{n_{max}} R_{thn} \left( 1 - e^{-\frac{t}{\tau_n}} \right)$$



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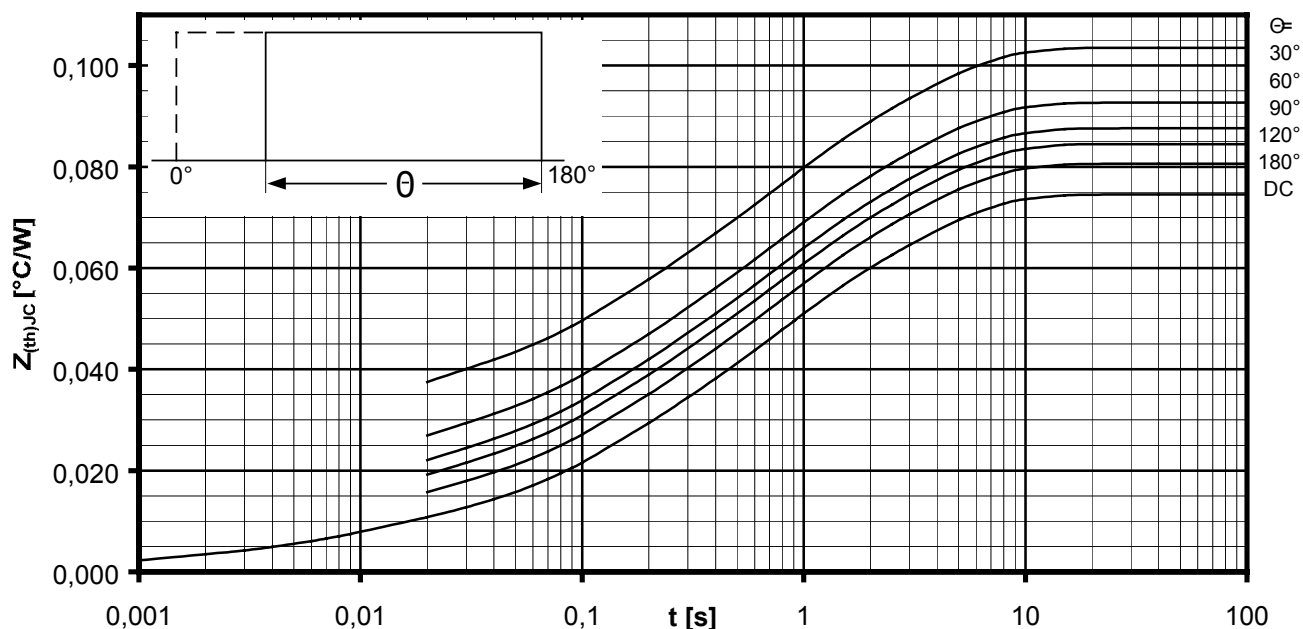
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Transienter innerer Wärmewiderstand je Zweig / Transient thermal impedance per arm  $Z_{thJC} = f(t)$

Sinusförmiger Strom / Sinusoidal current

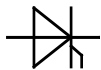
Parameter: Stromflußwinkel  $\Theta$  / Current conduction angle  $\Theta$



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

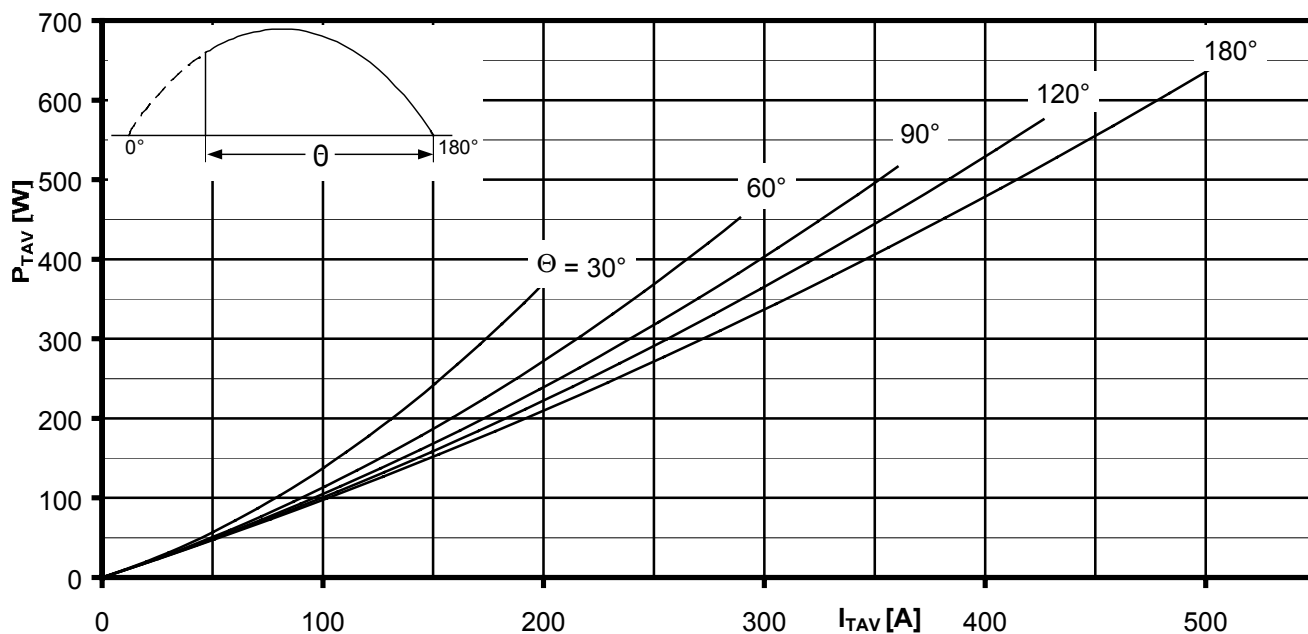
Rechteckförmiger Strom / Rectangular current

Parameter: Stromflußwinkel  $\Theta$  / Current conduction angle  $\Theta$



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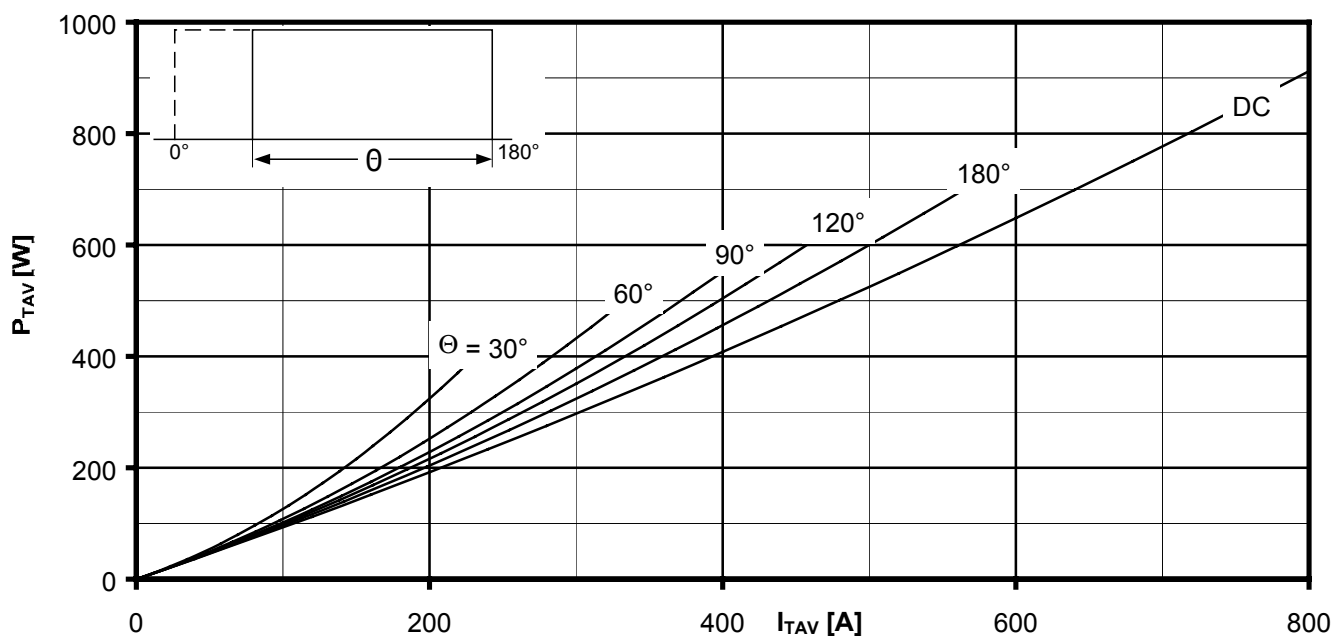
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**Durchlassverlustleistung je Zweig / On-state power loss per arm  $P_{TAV} = f(I_{TAV})$**

Sinusförmiger Strom / Sinusoidal current    Strombelastung je Zweig / Current load per arm

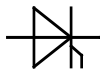
Parameter: Stromflußwinkel / Current conduction angle  $\Theta$



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

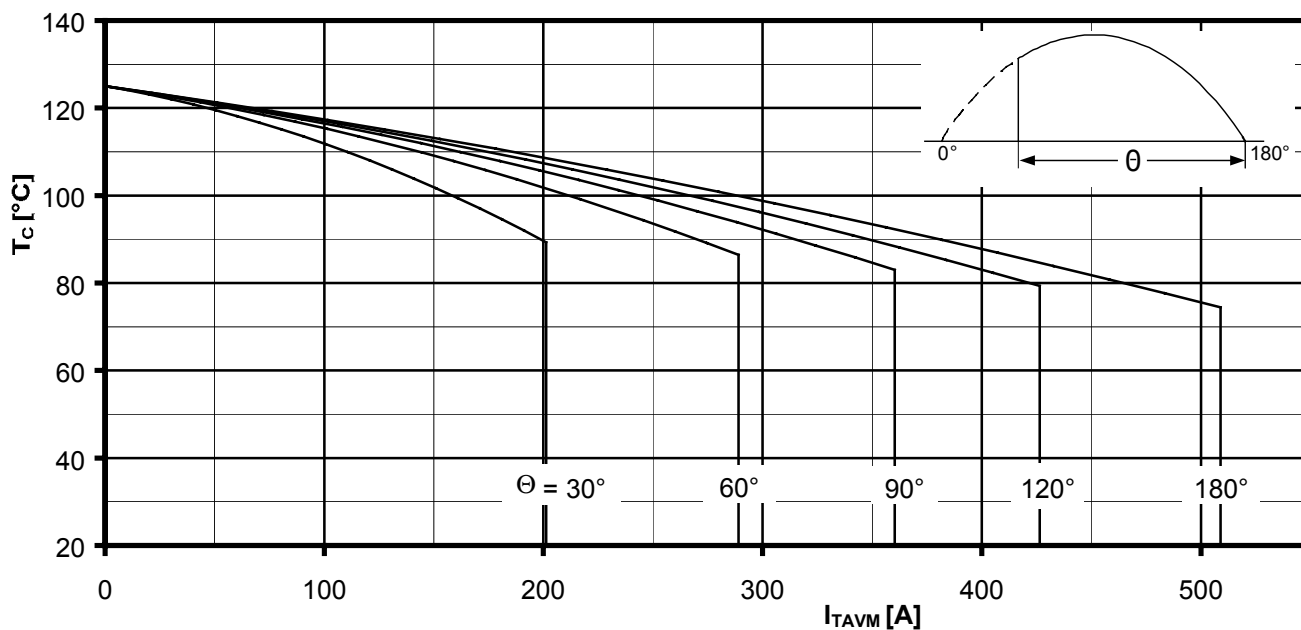
Rechteckförmiger Strom / Rectangular current    Strombelastung je Zweig / Current load per arm

Parameter: Stromflußwinkel / Current conduction angle  $\Theta$



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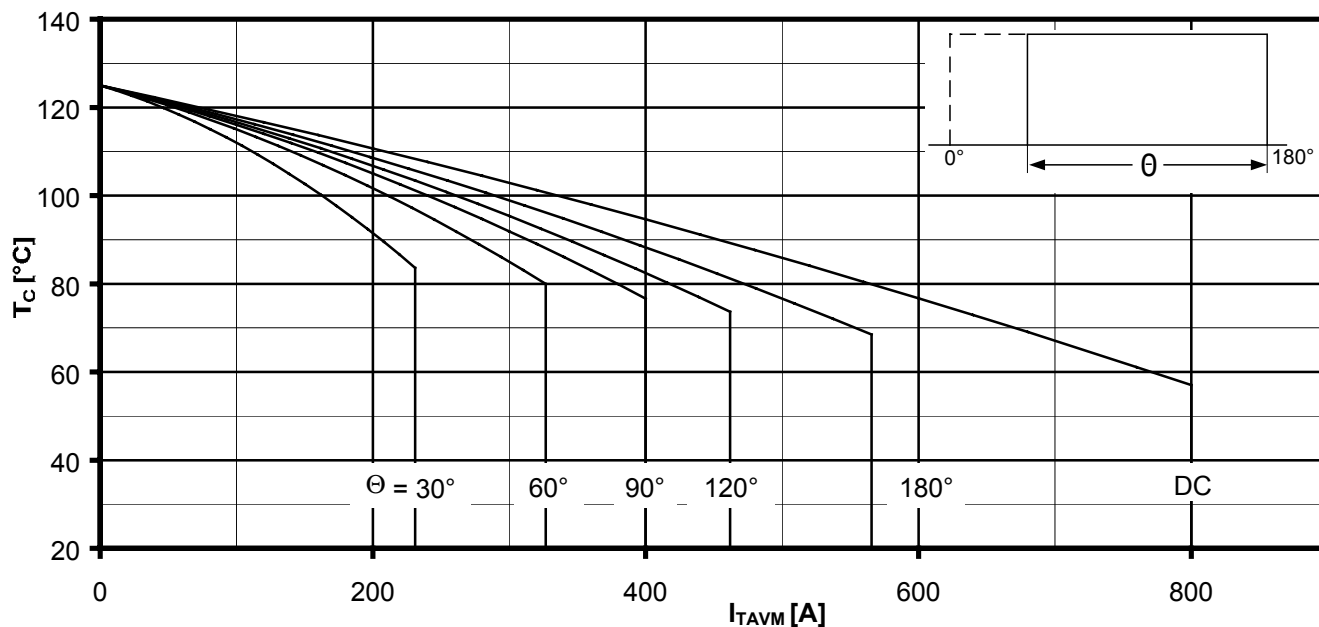
**TZ425N**



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

Sinusförmiger Strom / Sinusoidal current Strombelastung je Zweig / Current load per arm

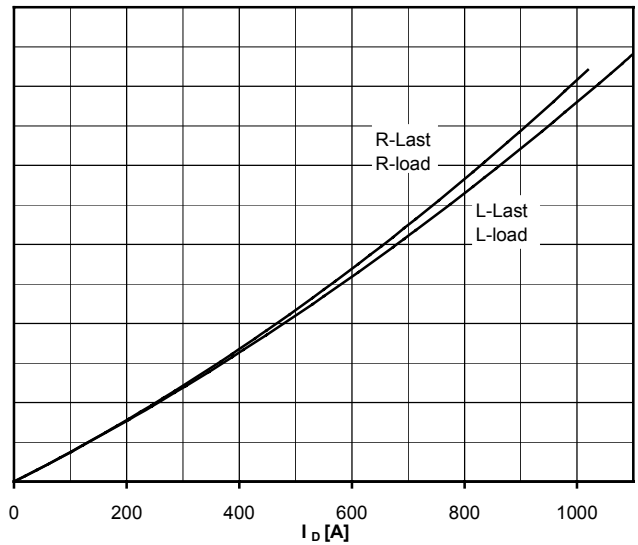
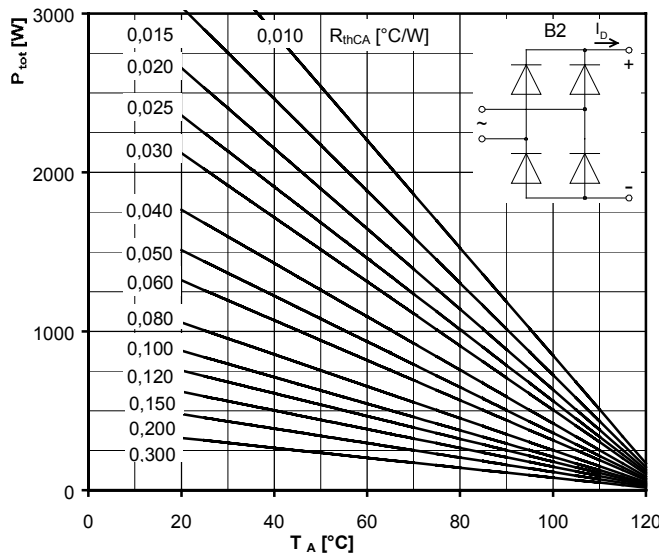
Parameter: Stromflußwinkel  $\Theta$  / Current conduction angle  $\Theta$



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

Rechteckförmiger Strom / Rectangular current Strombelastung je Zweig / Current load per arm

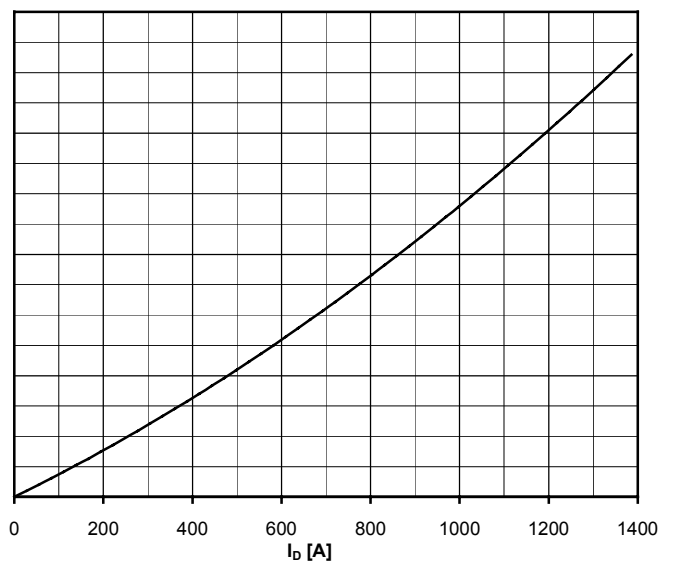
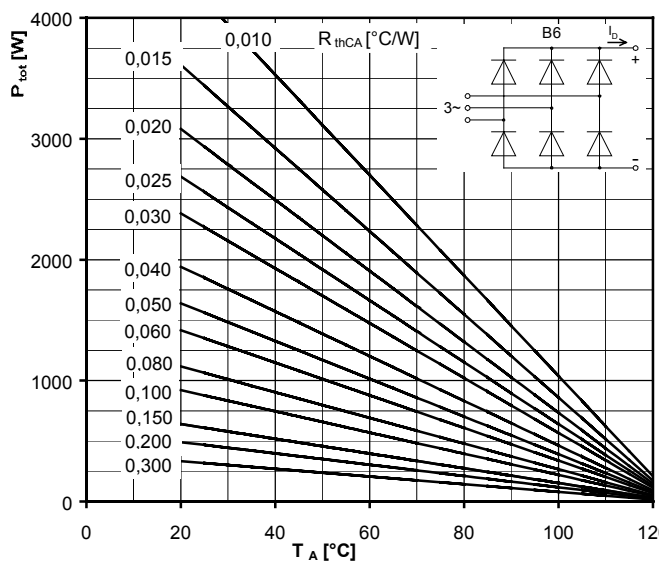
Parameter: Stromflußwinkel  $\Theta$  / Current conduction angle  $\Theta$


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**Höchstzulässiger Ausgangsstrom / Maximum rated output current  $I_D$** 

B2- Zweipuls-Brückenschaltung / Two-pulse bridge circuit

 Gesamtverlustleistung der Schaltung / Total power dissipation at circuit  $P_{tot}$ 

Parameter:

 Wärmewiderstand zwischen den Gehäusen und Umgebung / Thermal resistance cases to ambient  $R_{thCA}$ 

**Höchstzulässiger Ausgangsstrom / Maximum rated output current  $I_D$** 

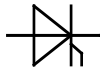
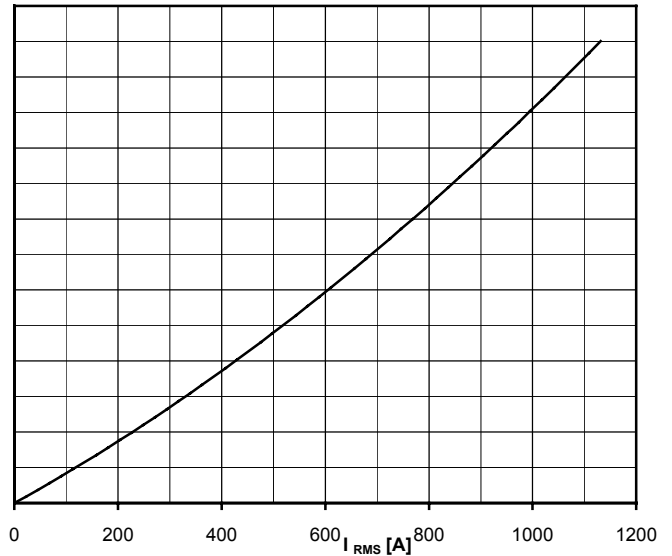
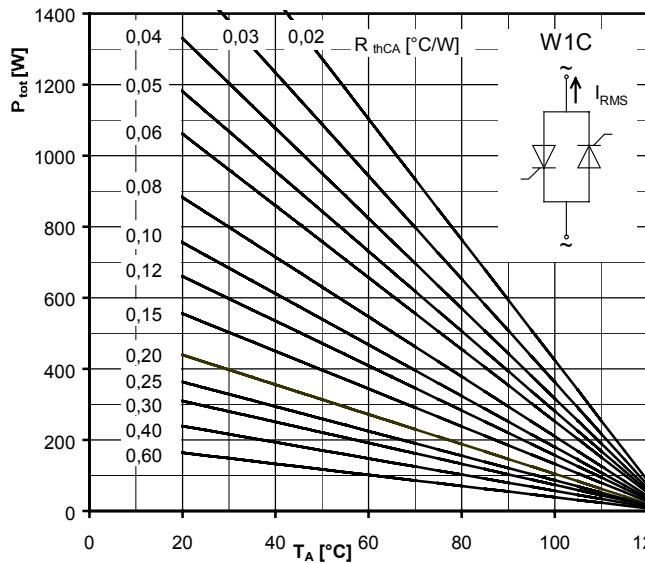
B6- Sechspuls-Brückenschaltung / Six-pulse bridge circuit

 Gesamtverlustleistung der Schaltung / Total power dissipation at circuit  $P_{tot}$ 

Parameter:

 Wärmewiderstand zwischen den Gehäusen und Umgebung / Thermal resistance cases to ambient  $R_{thCA}$

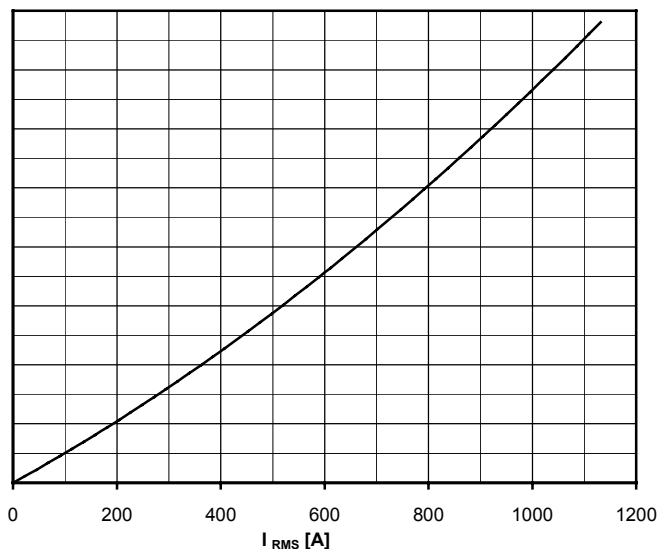
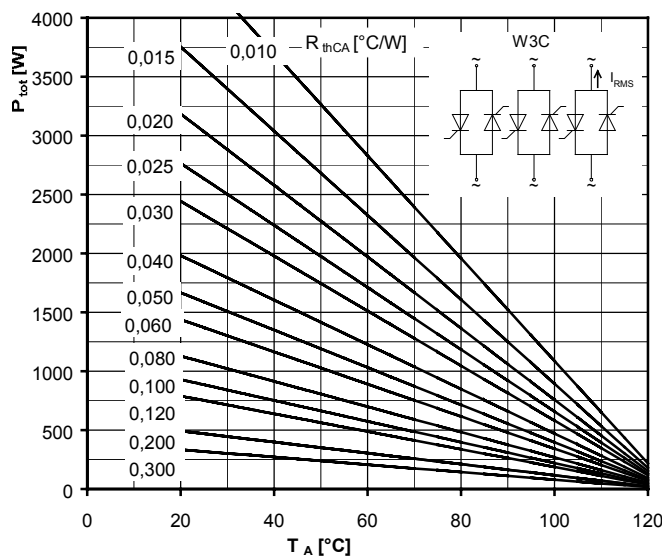



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**Höchstzulässiger Effektivstrom / Maximum rated RMS current  $I_{RMS}$** 

W1C - Einphasen-Wechselwegschaltung / Single-phase inverse parallel circuit

Gesamtverlustleistung der Schaltung / Total power dissipation at circuit  $P_{tot}$ 

Parameter:

Wärmewiderstand zwischen den Gehäusen und Umgebung / Thermal resistance case to ambient  $R_{thCA}$ 

**Höchstzulässiger Effektivstrom / Maximum rated RMS current  $I_{RMS}$** 

W3C - Dreiphasen-Wechselwegschaltung / Three-phase inverse parallel circuit

Gesamtverlustleistung der Schaltung / Total power dissipation at circuit  $P_{tot}$ 

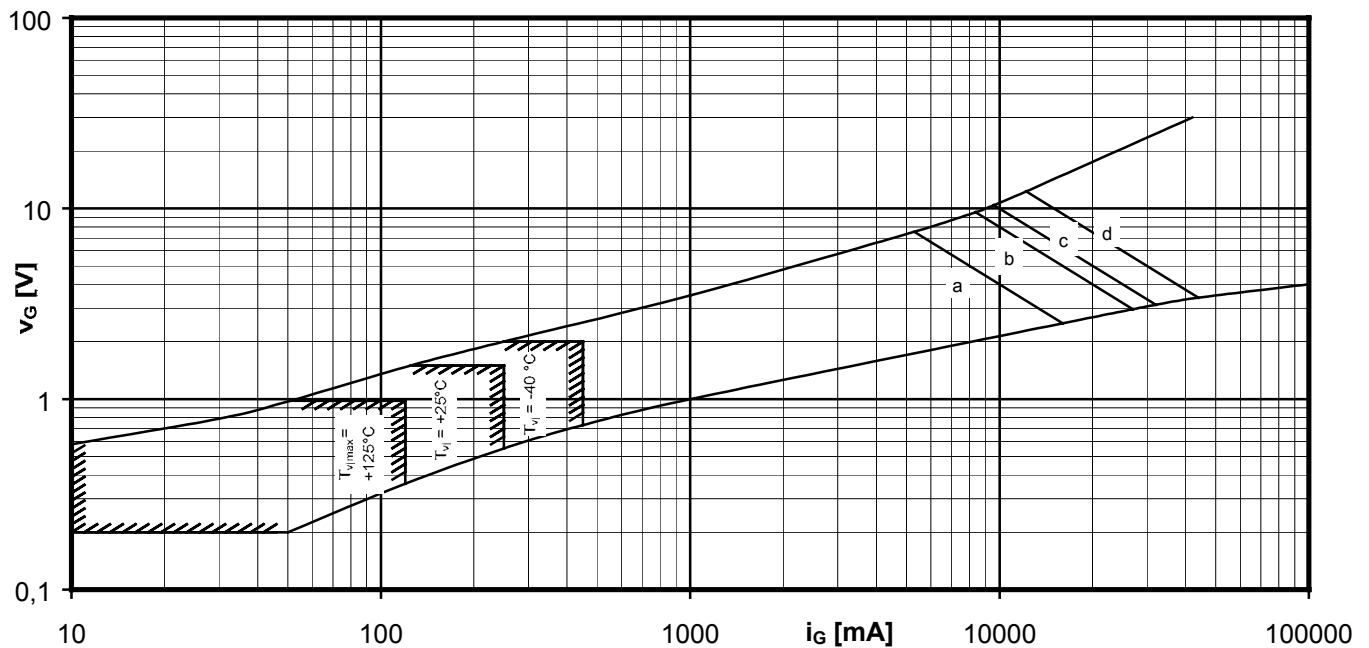
Parameter:

Wärmewiderstand zwischen den Gehäusen und Umgebung / Thermal resistance cases to ambient  $R_{thCA}$



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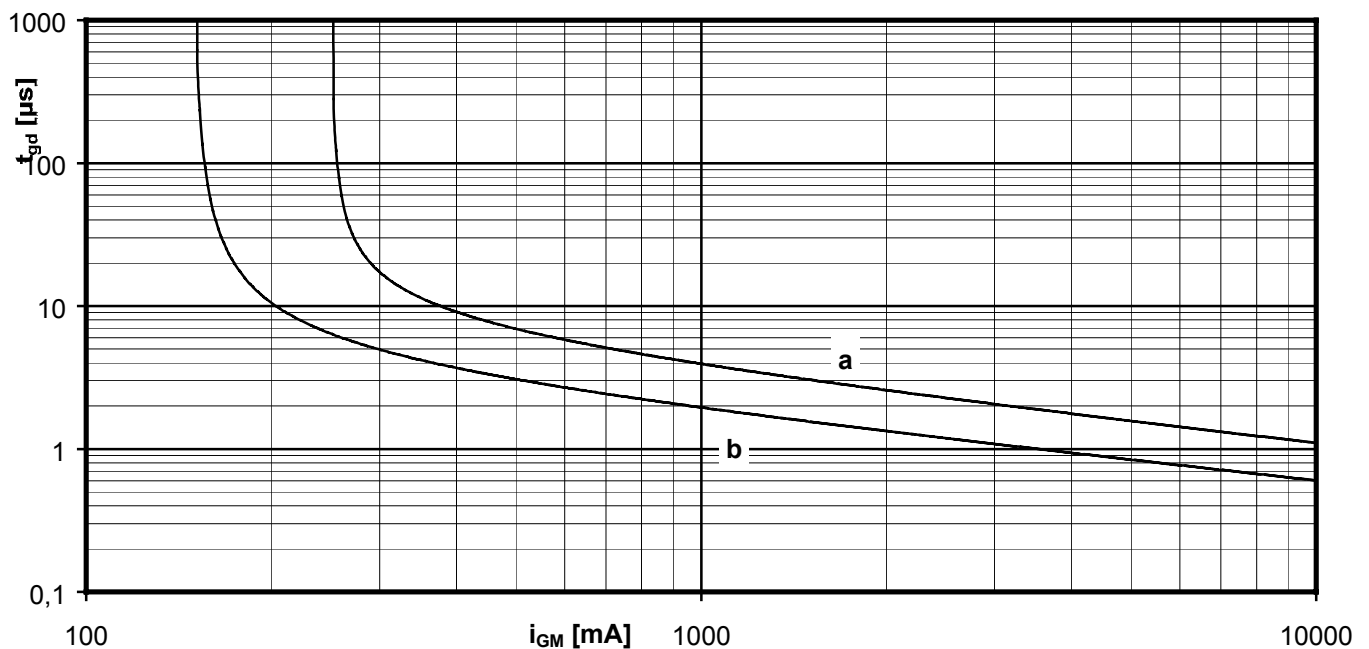
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Steuercharakteristik  $v_G = f(i_G)$  mit Zündbereichen für  $V_D = 6\text{ V}$   
Gate characteristic  $v_G = f(i_G)$  with triggering area for  $V_D = 6\text{ V}$

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

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

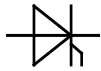


Zündverzögerung / Gate controlled delay time  $t_{gd} = f(i_G)$

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

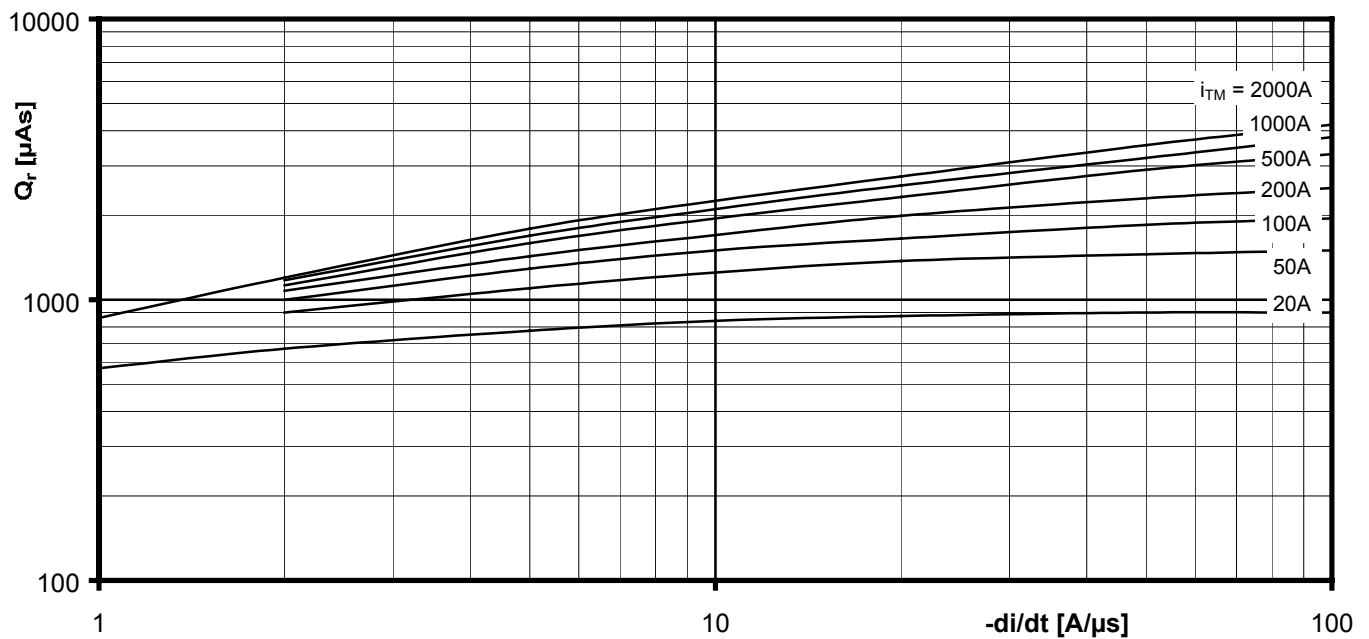
a - maximaler Verlauf / Limiting characteristic

b - typischer Verlauf / Typical characteristic



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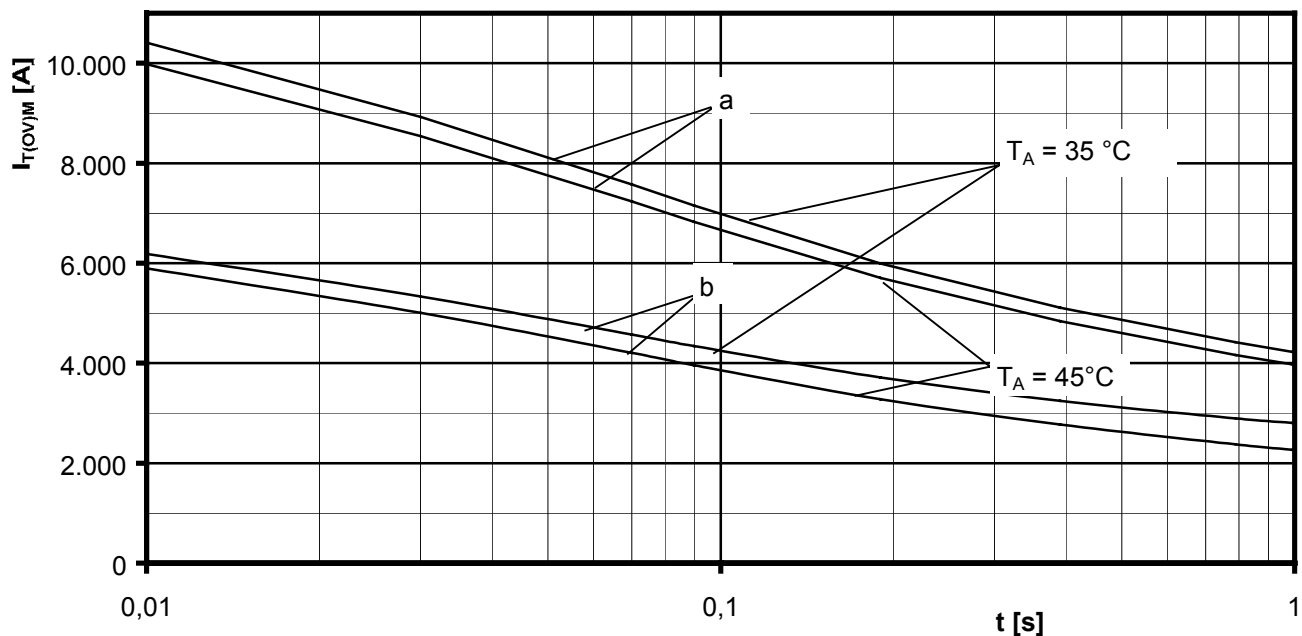
**TZ425N**



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

$$T_{vj} = T_{vjmax}, V_R \leq 0,5 V_{RRM}, V_{RM} = 0,8 V_{RRM}$$

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



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

a: Leerlauf / No-load conditions

b: nach Belastung mit  $I_{TAVM}$  / after load with  $I_{TAVM}$

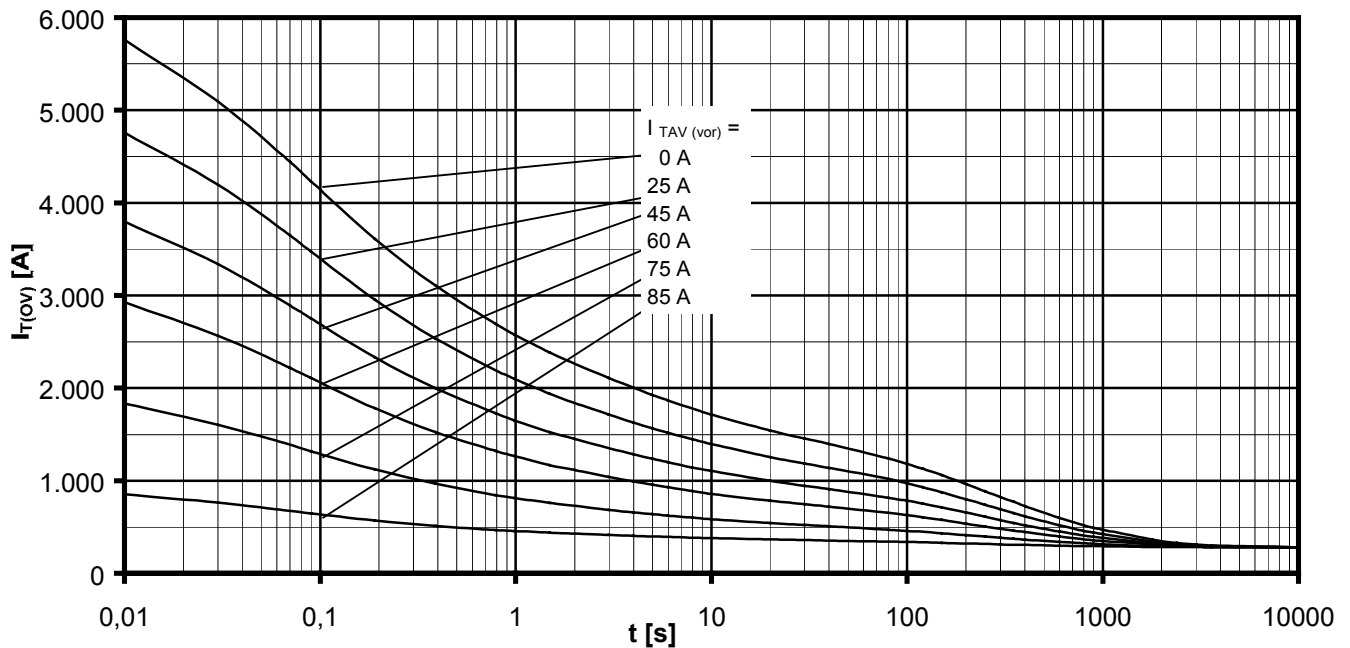
$T_A = 35^\circ\text{C}$ , verstärkte Luftkühlung / Forced air cooling

$T_A = 45^\circ\text{C}$ , Luftselbstkühlung / Natural air cooling



Netz-Thyristor-Modul  
Phase Control Thyristor Module

**TZ425N**

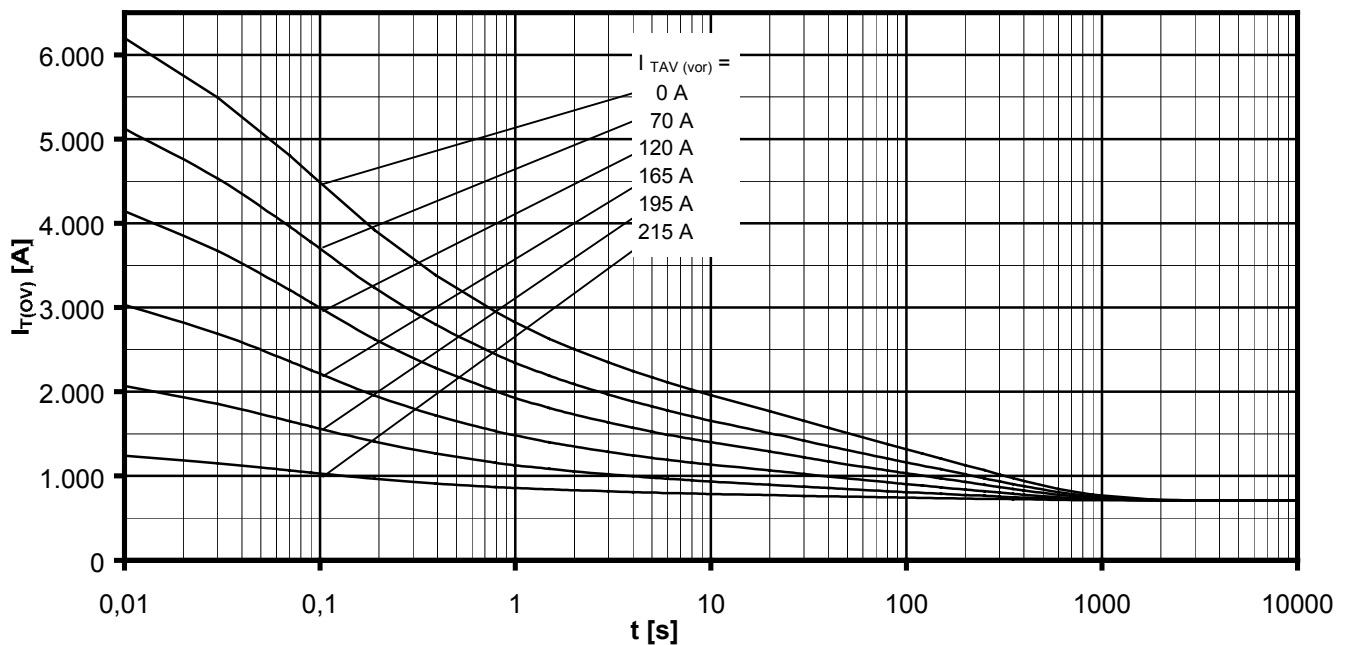


Überstrom je Zweig / Overload on-state current  $I_{T(ov)}$

B6- Sechspuls-Brückenschaltung,  $120^\circ$  Rechteck / Six-pulse bridge circuit,  $120^\circ$  rectangular

Kühlkörper / Heatsink type KM17 (90W)      Luftselbstkühlung bei / Natural cooling at  $T_A = 45^\circ\text{C}$

Parameter: Vorlaststrom je Zweig / Pre-load current per arm  $I_{TAV(vor)}$



Überstrom je Zweig / Overload on-state current  $I_{T(ov)}$

B6- Sechspuls-Brückenschaltung,  $120^\circ$  Rechteck / Six-pulse bridge circuit,  $120^\circ$  rectangular

Kühlkörper / Heatsink type KM17 (Papst 4650N)      Verstärkte Kühlung bei / Forced cooling at  $T_A = 35^\circ\text{C}$

Parameter: Vorlaststrom je Zweig / Pre-load current per arm  $I_{TAV(vor)}$