

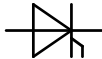

Netz-Thyristor
Phase Control Thyristor
T720N
Elektrische Eigenschaften / Electrical properties
 Höchstzulässige Werte / Maximum rated values

| | | | | | |
|--|--|----------------------------------|--------------|----------------|--|
| Periodische Vorwärts- und Rückwärts-Spitzensperrspannung repetitive peak forward off-state and reverse voltages | $T_{vj} = -40^{\circ}\text{C} \dots T_{vj \text{ max}}$ | $V_{\text{DRM}}, V_{\text{RRM}}$ | 1200 1400 | 1600 1800 | V V |
| Vorwärts-Stosspitzensperrspannung non-repetitive peak forward off-state voltage | $T_{vj} = -40^{\circ}\text{C} \dots T_{vj \text{ max}}$ | V_{DSM} | 1200 1400 | 1600 1800 | V V |
| Rückwärts-Stosspitzensperrspannung non-repetitive peak reverse voltage | $T_{vj} = +25^{\circ}\text{C} \dots T_{vj \text{ max}}$ | V_{RSM} | 1300 1500 | 1700 1900 | V V |
| Durchlassstrom-Grenzeffektivwert maximum RMS on-state current | | I_{TRMSM} | | 1500 | A |
| Dauergrenzstrom average on-state current | $T_{\text{C}} = 85^{\circ}\text{C}$ | I_{TAVM} | | 720 | A |
| Dauergrenzstrom average on-state current | $T_{\text{C}} = 55^{\circ}\text{C}, \theta = 180^{\circ}\sin, t_{\text{p}} = 10 \text{ ms}$ | I_{TAVM} | | 1050 | A |
| Durchlaßstrom-Effektivwert RMS on-state current | | I_{TRMS} | | 1650 | A |
| Stossstrom-Grenzwert surge current | $T_{vj} = 25^{\circ}\text{C}, t_{\text{p}} = 10 \text{ ms}$ $T_{vj} = T_{vj \text{ max}}, t_{\text{p}} = 10 \text{ ms}$ | I_{TSM} | | 14500 12500 | A A |
| Grenzlastintegral I^2t -value | $T_{vj} = 25^{\circ}\text{C}, t_{\text{p}} = 10 \text{ ms}$ $T_{vj} = T_{vj \text{ max}}, t_{\text{p}} = 10 \text{ ms}$ | I^2t | | 1051 781 | $10^3 \text{ A}^2\text{s}$ $10^3 \text{ A}^2\text{s}$ |
| Kritische Stromsteilheit critical rate of rise of on-state current | DIN IEC 60747-6 $f = 50 \text{ Hz}, i_{\text{GM}} = 1 \text{ A}, di_{\text{G}}/dt = 1 \text{ A}/\mu\text{s}$ | $(di_{\text{T}}/dt)_{\text{cr}}$ | | 120 | A/ μs |
| Kritische Spannungssteilheit critical rate of rise of off-state voltage | $T_{vj} = T_{vj \text{ max}}, V_{\text{D}} = 0,67 V_{\text{DRM}}$ 5.Kennbuchstabe / 5 th letter F | $(dv_{\text{D}}/dt)_{\text{cr}}$ | | 1000 | V/ μs |

Charakteristische Werte / Characteristic values

| | | | | | |
|---|--|------------------------------|--------------|---|---------------|
| Durchlassspannung on-state voltage | $T_{vj} = T_{vj \text{ max}}, i_{\text{T}} = 3000 \text{ A}$ $T_{vj} = T_{vj \text{ max}}, i_{\text{T}} = 750 \text{ A}$ | V_{T} | max. max. | 1,94 1,20 | V V |
| Schleusenspannung threshold voltage | $T_{vj} = T_{vj \text{ max}}$ | $V_{(\text{TO})}$ | | 0,85 | V |
| Ersatzwiderstand slope resistance | $T_{vj} = T_{vj \text{ max}}$ | r_{T} | | 0,35 | m Ω |
| Durchlasskennlinie on-state characteristic $300 \text{ A} \leq i_{\text{T}} \leq 3500 \text{ A}$ $v_{\text{T}} = A + B \cdot i_{\text{T}} + C \cdot \ln(i_{\text{T}} + 1) + D \cdot \sqrt{i_{\text{T}}}$ | $T_{vj} = T_{vj \text{ max}}$ | A= B= C= D= | | 1,173E+00 1,489E-04 -9,456E-02 1,966E-02 | |
| Zündstrom gate trigger current | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}$ | I_{GT} | max. | 250 | mA |
| Zündspannung gate trigger voltage | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}$ | V_{GT} | max. | 1,5 | V |
| Nicht zündender Steuerstrom gate non-trigger current | $T_{vj} = T_{vj \text{ max}}, V_{\text{D}} = 12\text{V}$ $T_{vj} = T_{vj \text{ max}}, V_{\text{D}} = 0,5 V_{\text{DRM}}$ | I_{GD} | max. max. | 10 5 | mA mA |
| Nicht zündende Steuerspannung gate non-trigger voltage | $T_{vj} = T_{vj \text{ max}}, V_{\text{D}} = 0,5 V_{\text{DRM}}$ | V_{GD} | max. | 0,2 | V |
| Haltestrom holding current | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}$ | I_{H} | max. | 300 | mA |
| Einraststrom latching current | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}, R_{\text{GK}} \geq 10 \Omega$ $i_{\text{GM}} = 1 \text{ A}, di_{\text{G}}/dt = 1 \text{ A}/\mu\text{s}, t_{\text{g}} = 20 \mu\text{s}$ | I_{L} | max. | 1500 | mA |
| Vorwärts- und Rückwärts-Sperrstrom forward off-state and reverse current | $T_{vj} = T_{vj \text{ max}}$ $V_{\text{D}} = V_{\text{DRM}}, V_{\text{R}} = V_{\text{RRM}}$ | $i_{\text{D}}, i_{\text{R}}$ | max. | 80 | mA |
| Zündverzug gate controlled delay time | DIN IEC 60747-6 $T_{vj} = 25^{\circ}\text{C}, i_{\text{GM}} = 1 \text{ A}, di_{\text{G}}/dt = 1 \text{ A}/\mu\text{s}$ | t_{gd} | max. | 4 | μs |

| | | | |
|--------------|------------|----------------------|------------|
| prepared by: | H.Sandmann | date of publication: | 2008-10-13 |
| approved by: | M.Leifeld | revision: | 1.0 |


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 Charakteristische Werte / Characteristic values

| | | | | |
|---|--|-------|----------|---------|
| Freiwerdezeit circuit commutated turn-off time | $T_{vj} = T_{vj\ max}$, $i_{TM} = I_{TAVM}$ $V_{RM} = 100\ V$, $V_{DM} = 0,67\ V_{DRM}$ $dv_D/dt = 20\ V/\mu s$, $-di_T/dt = 10\ A/\mu s$ 4.Kennbuchstabe / 4 th letter O | t_q | typ. 250 | μs |
|---|--|-------|----------|---------|

Thermische Eigenschaften / Thermal properties

| | | | | |
|--|--|---------------|--|--|
| Innerer Wärmewiderstand thermal resistance, junction to case | <u>Kühlfläche / cooling surface</u> beidseitig / two-sided, $\theta = 180^\circ\ sin$ beidseitig / two-sided, DC Anode / anode, $\theta = 180^\circ\ sin$ Anode / anode, DC Kathode / cathode, $\theta = 180^\circ\ sin$ Kathode / cathode, DC | R_{thJC} | max. 0,038 max. 0,036 max. 0,068 max. 0,065 max. 0,082 max. 0,080 | $^\circ C/W$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$ |
| Übergangs-Wärmewiderstand thermal resistance, case to heatsink | <u>Kühlfläche / cooling surface</u> beidseitig / two-sides einseitig / single-sides | R_{thCH} | max. 0,005 max. 0,010 | $^\circ C/W$ $^\circ C/W$ |
| Höchstzulässige Sperrschichttemperatur maximum junction temperature | | $T_{vj\ max}$ | 125 | $^\circ C$ |
| Betriebstemperatur operating temperature | | $T_{c\ op}$ | -40...+125 | $^\circ C$ |
| Lagertemperatur storage temperature | | T_{stg} | -40...+150 | $^\circ C$ |

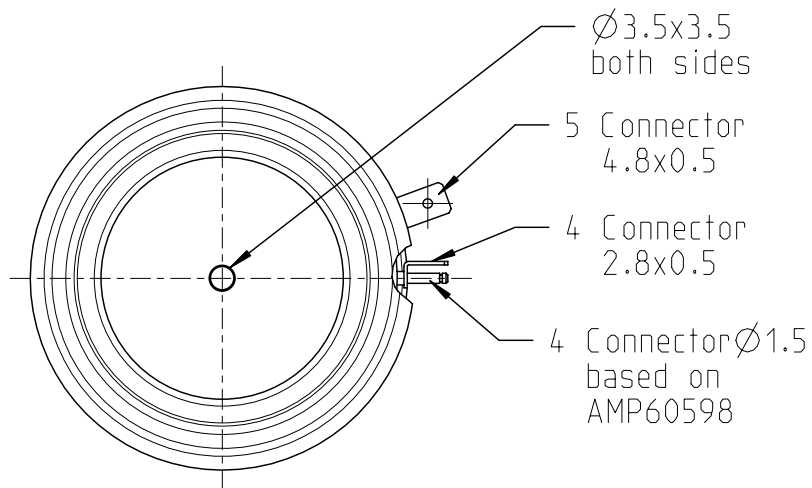
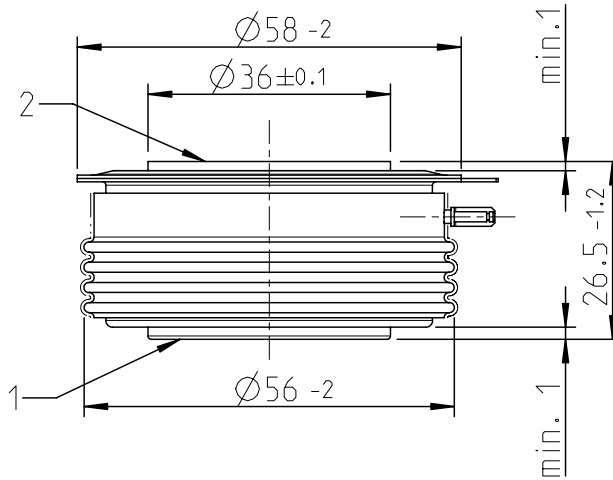
Mechanische Eigenschaften / Mechanical properties

| | | | | |
|--|--|---|---|------------------|
| Gehäuse, siehe Anlage case, see annex | | | Seite 3 page 3 | |
| Si-Element mit Druckkontakt Si-pellet with pressure contact | | | | |
| Anpresskraft clamping force | | F | 9...18 | kN |
| Steueranschlüsse control terminals | Gate (flat) Gate (round, based on AMP 60598) Kathode / cathode | | A 2,8x0,5 \varnothing 1,5 A 4,8x0,5 | mm mm mm |
| Gewicht weight | | G | typ. 270 | g |
| Kriechstrecke creepage distance | | | 20 | mm |
| Schwingfestigkeit vibration resistance | f = 50 Hz | | 50 | m/s ² |



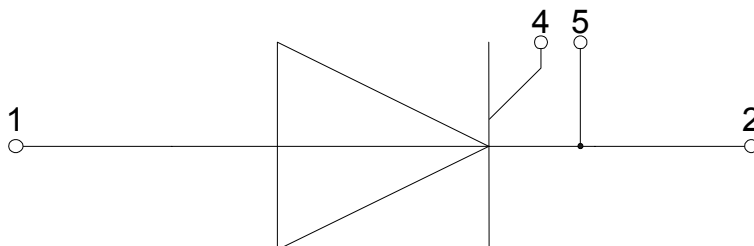
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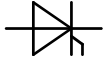


strike distance: 15mm
creepage distance: 20mm

overall height based
on contact pressure



- 1:** Anode / Anode
- 2:** Kathode / Cathode
- 4:** Gate
- 5:** Hilfskathode/
Auxiliary Cathode



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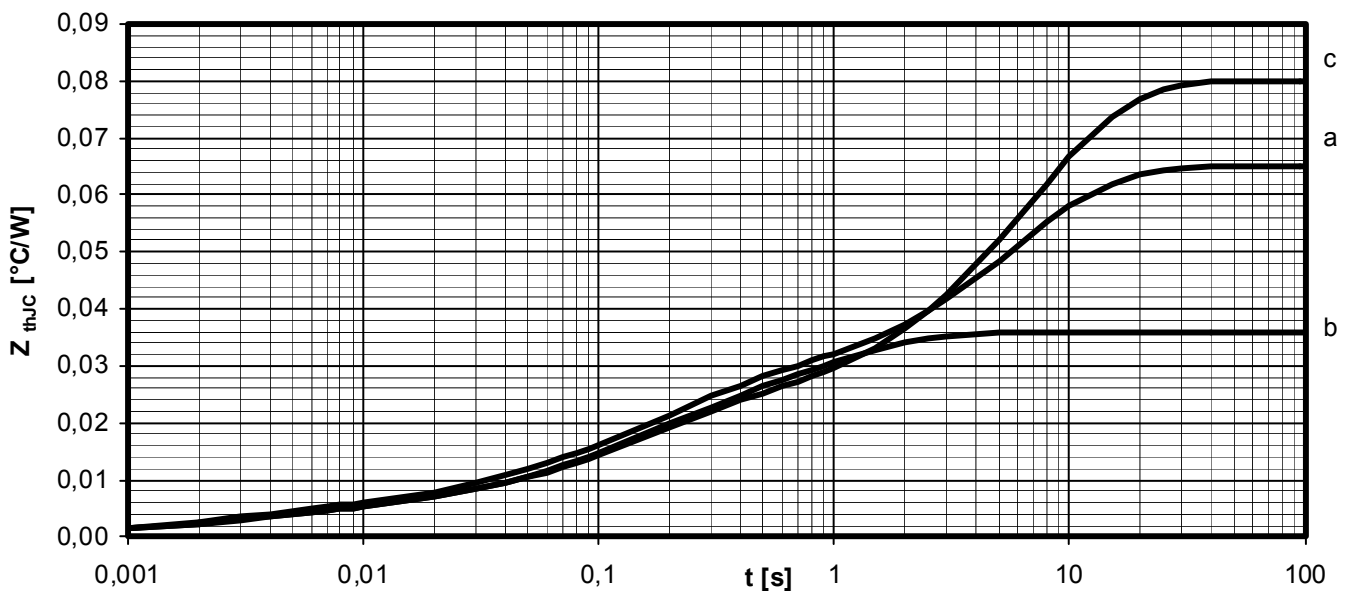
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Analytische Elemente des transienten Wärmewiderstandes Z_{thJC} für DC
Analytical elements of transient thermal impedance Z_{thJC} for DC

| Kühlung / Cooling | Pos. n | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---------------------------------|------------------|---------|---------|---------|---------|---------|--------|---|
| beidseitig two-sided | R_{thn} [°C/W] | 0,00017 | 0,00338 | 0,00429 | 0,01355 | 0,01461 | - | - |
| | τ_n [s] | 0,00027 | 0,00261 | 0,04170 | 0,17300 | 0,99900 | - | - |
| anodenseitig anode-sided | R_{thn} [°C/W] | 0,00022 | 0,00368 | 0,00407 | 0,01813 | 0,0389 | - | - |
| | τ_n [s] | 0,00033 | 0,00260 | 0,02970 | 0,18200 | 5,8300 | - | - |
| kathodenseitig cathode-sided | R_{thn} [°C/W] | 0,00022 | 0,00305 | 0,00216 | 0,01625 | 0,00482 | 0,0535 | - |
| | τ_n [s] | 0,00033 | 0,00254 | 0,01790 | 0,14600 | 0,01355 | 6,8200 | - |

Analytische Funktion / Analytical function:

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



Transienter innerer Wärmewiderstand für DC / Transient thermal impedance for DC
 $Z_{thJC} = f(t)$

- a - Anodenseitige Kühlung / Anode-sided cooling
b - Beidseitige Kühlung / Two-sided cooling
c - Kathodenseitige Kühlung / Cathode-sided cooling



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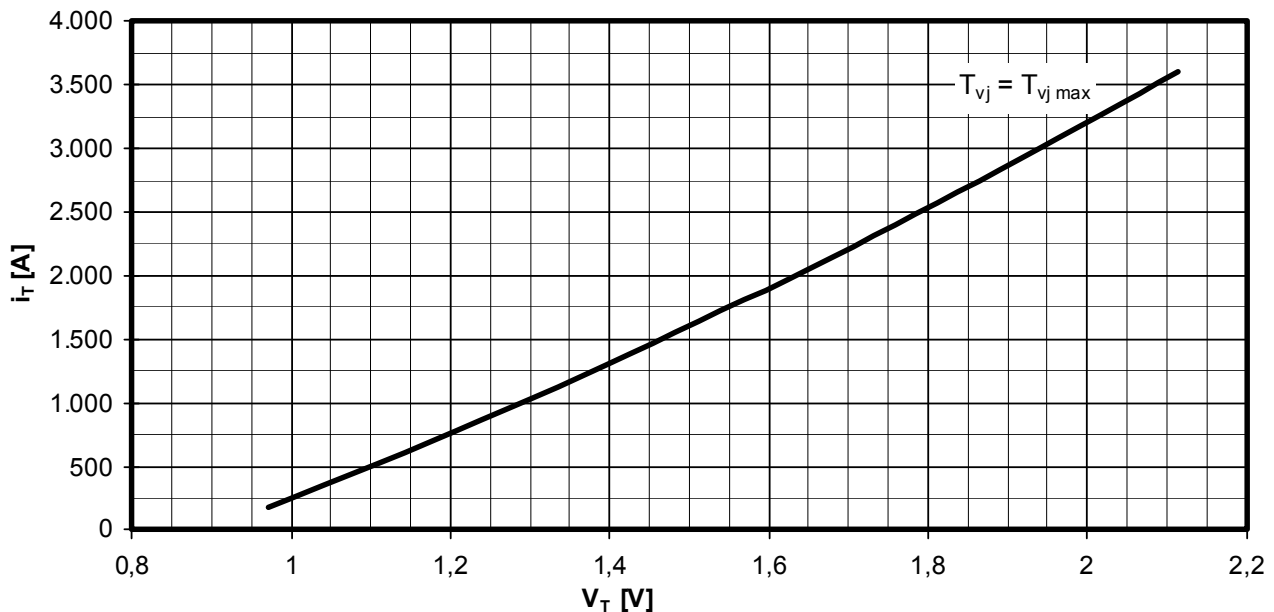
Erhöhung des $Z_{th DC}$ bei Sinus und Rechteckströmen mit unterschiedlichen Stromflusswinkeln Θ
Rise of $Z_{th DC}$ for sinewave and rectangular current with different current conduction angles Θ

$\Delta Z_{th \Theta rec} / \Delta Z_{th \Theta sin}$

| Kühlung / Cooling | | $\Theta = 180^\circ$ | $\Theta = 120^\circ$ | $\Theta = 90^\circ$ | $\Theta = 60^\circ$ | $\Theta = 30^\circ$ |
|---------------------------------|--------------------------------------|----------------------|----------------------|---------------------|---------------------|---------------------|
| beidseitig two-sided | $\Delta Z_{th \Theta rec}$ [°C/W] | 0,00438 | 0,00764 | 0,01017 | 0,01379 | 0,01951 |
| | $\Delta Z_{th \Theta sin}$ [°C/W] | 0,00279 | 0,00431 | 0,00644 | 0,00986 | 0,01591 |
| anodenseitig anode-sided | $\Delta Z_{th \Theta rec}$ [°C/W] | 0,00496 | 0,00860 | 0,01144 | 0,01551 | 0,02200 |
| | $\Delta Z_{th \Theta sin}$ [°C/W] | 0,00316 | 0,00486 | 0,00723 | 0,01105 | 0,01794 |
| kathodenseitig cathode-sided | $\Delta Z_{th \Theta rec}$ [°C/W] | 0,00434 | 0,00746 | 0,00998 | 0,01355 | 0,01935 |
| | $\Delta Z_{th \Theta sin}$ [°C/W] | 0,00274 | 0,00420 | 0,00625 | 0,00955 | 0,01562 |

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

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



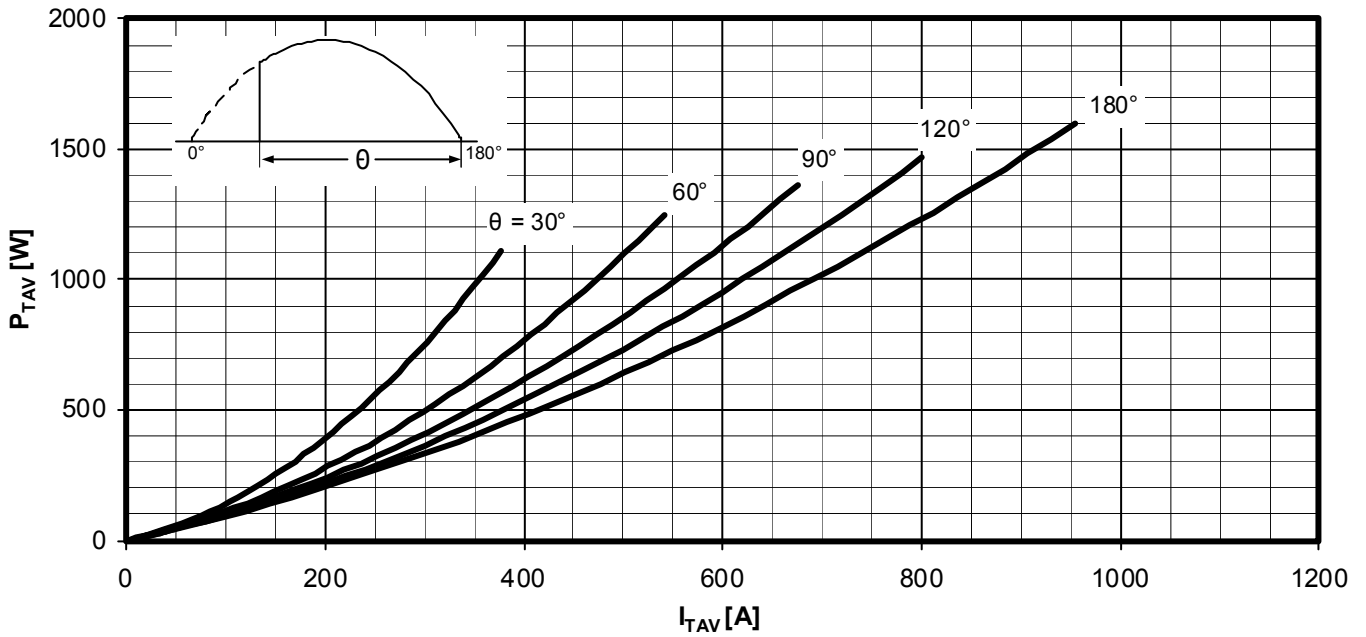
Grenzdurchlasskennlinie / Limiting on-state characteristic $i_T = f(v_T)$

$$T_{vj} = T_{vj max}$$



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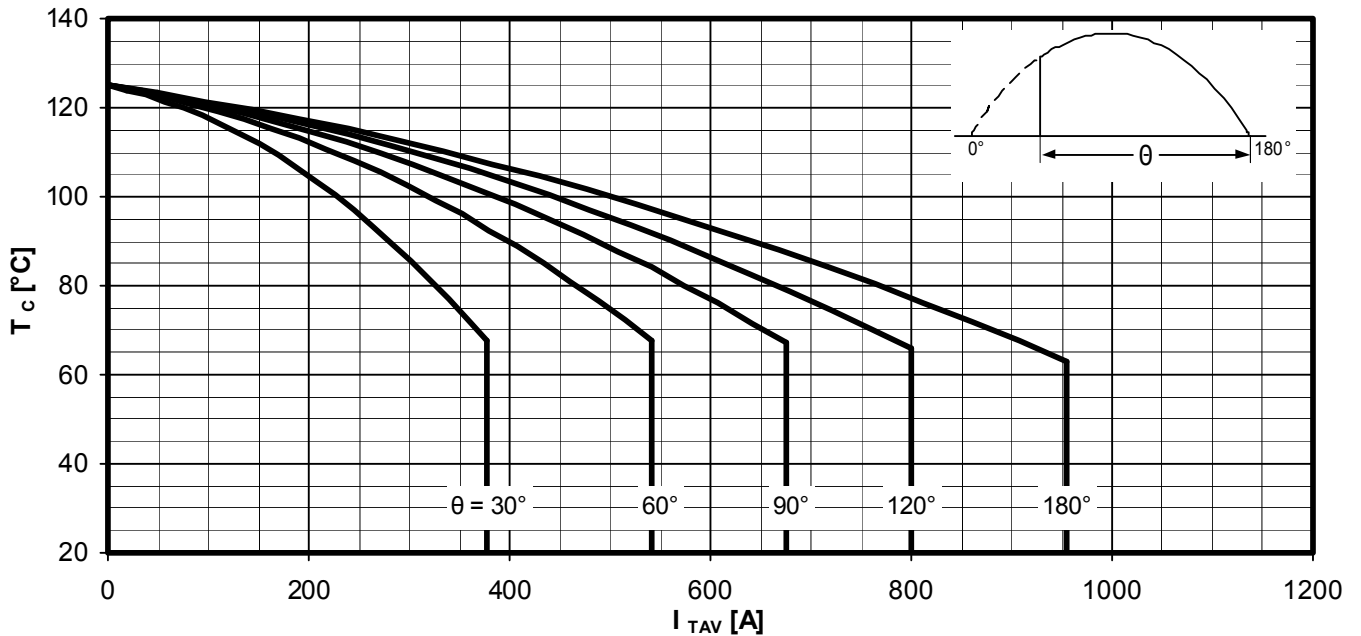
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Durchlassverlustleistung / On-state power loss $P_{TAV} = f(I_{TAV})$

Sinusförmiger Strom / Sinusoidal current

Parameter: Stromflusswinkel Θ / Current conduction angle Θ



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

Sinusförmiger Strom / Sinusoidal current

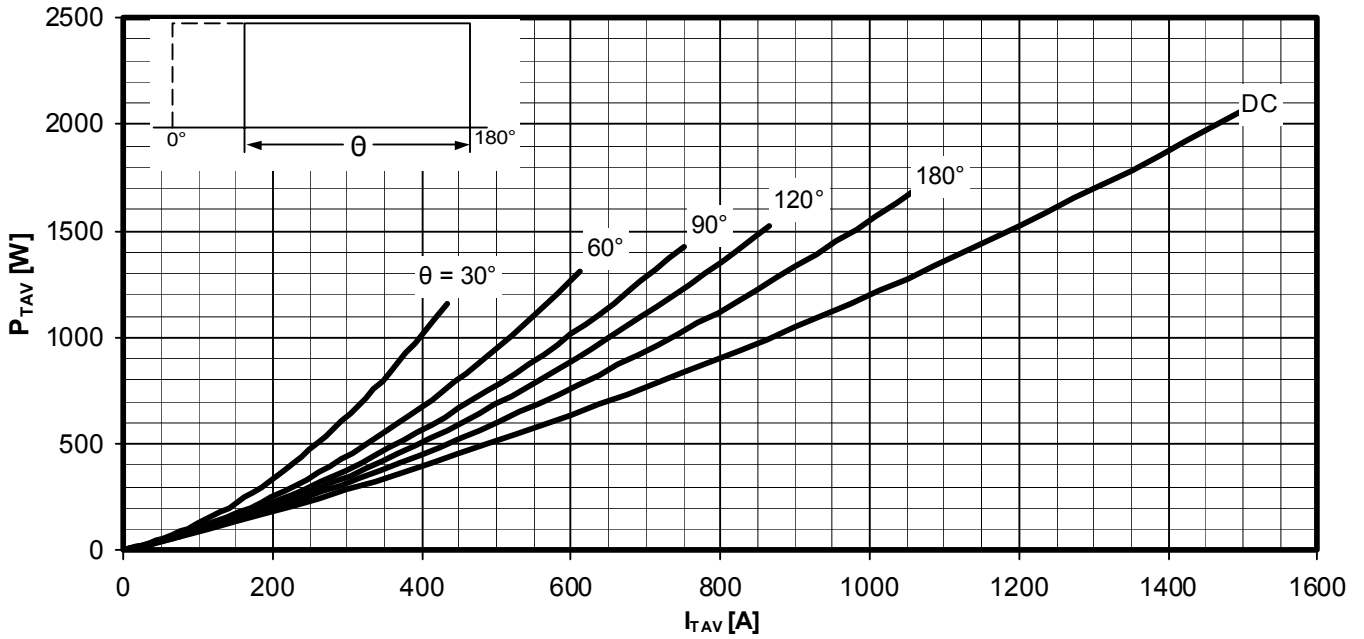
Beidseitige Kühlung / Two-sided cooling

Parameter: Stromflusswinkel Θ / Current conduction angle Θ



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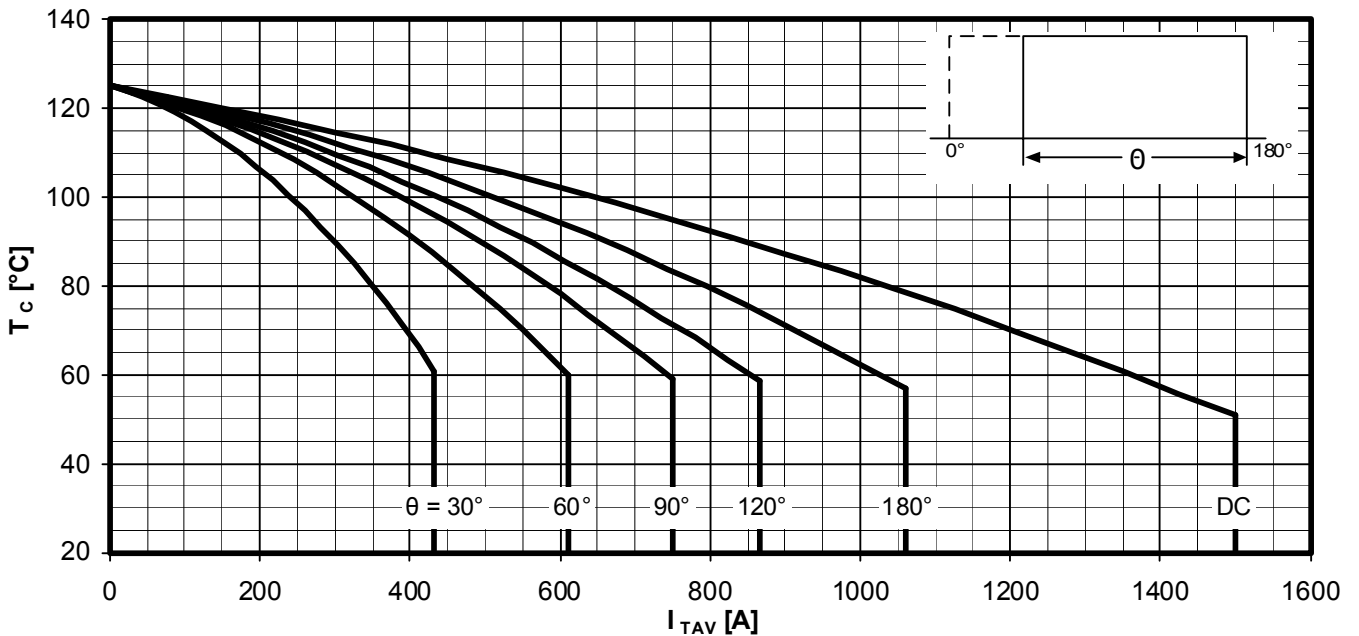
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Durchlassverlustleistung / On-state power loss $P_{TAV} = f(I_{TAV})$

Rechteckförmiger Strom / Rectangular current

Parameter: Stromflusswinkel Θ / Current conduction angle Θ



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

Rechteckförmiger Strom / Rectangular current

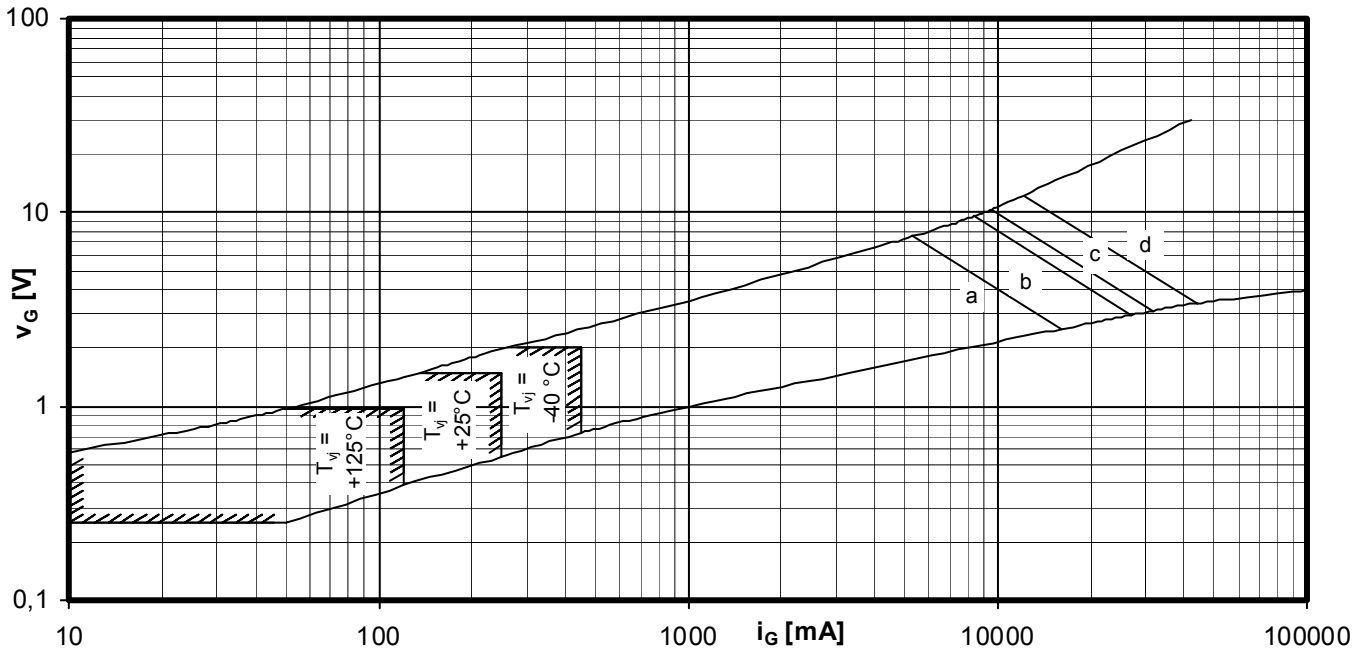
Beidseitige Kühlung / Two-sided cooling

Parameter: Stromflusswinkel Θ / Current conduction angle Θ



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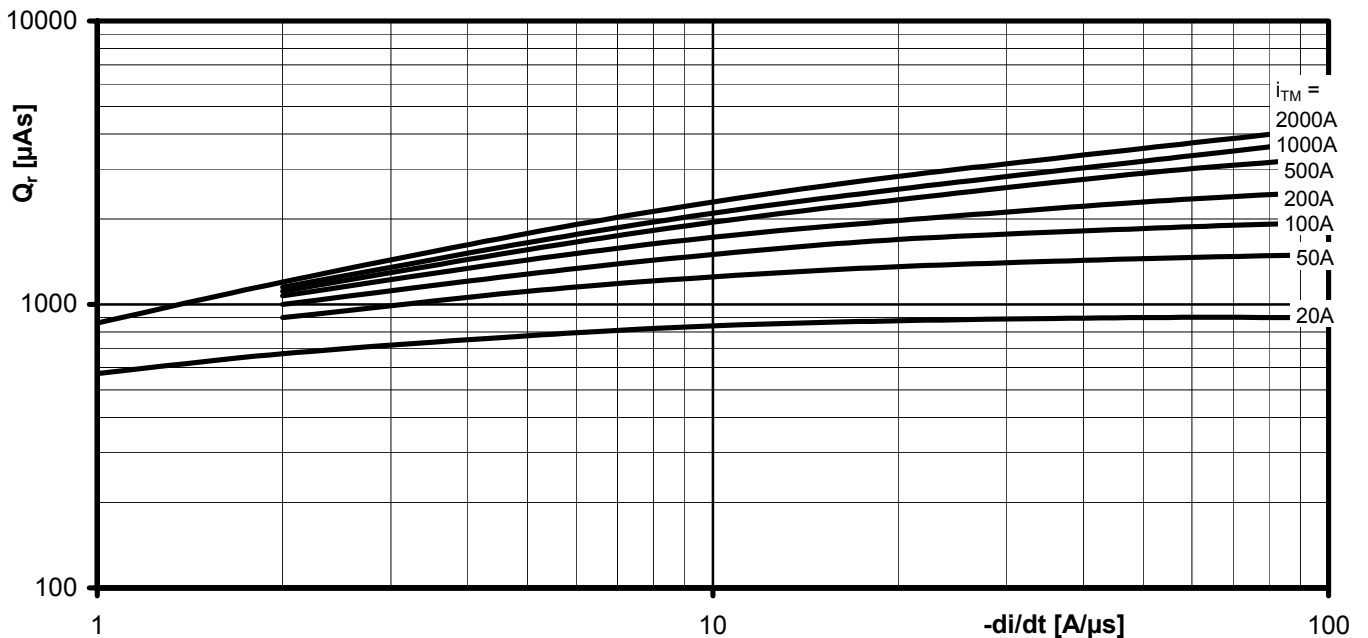
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Steuercharakteristik $v_G = f(i_G)$ mit Zündbereichen für $V_D = 12\text{ V}$
Gate characteristic $v_G = f(i_G)$ with triggering area for $V_D = 12\text{ V}$

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

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



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

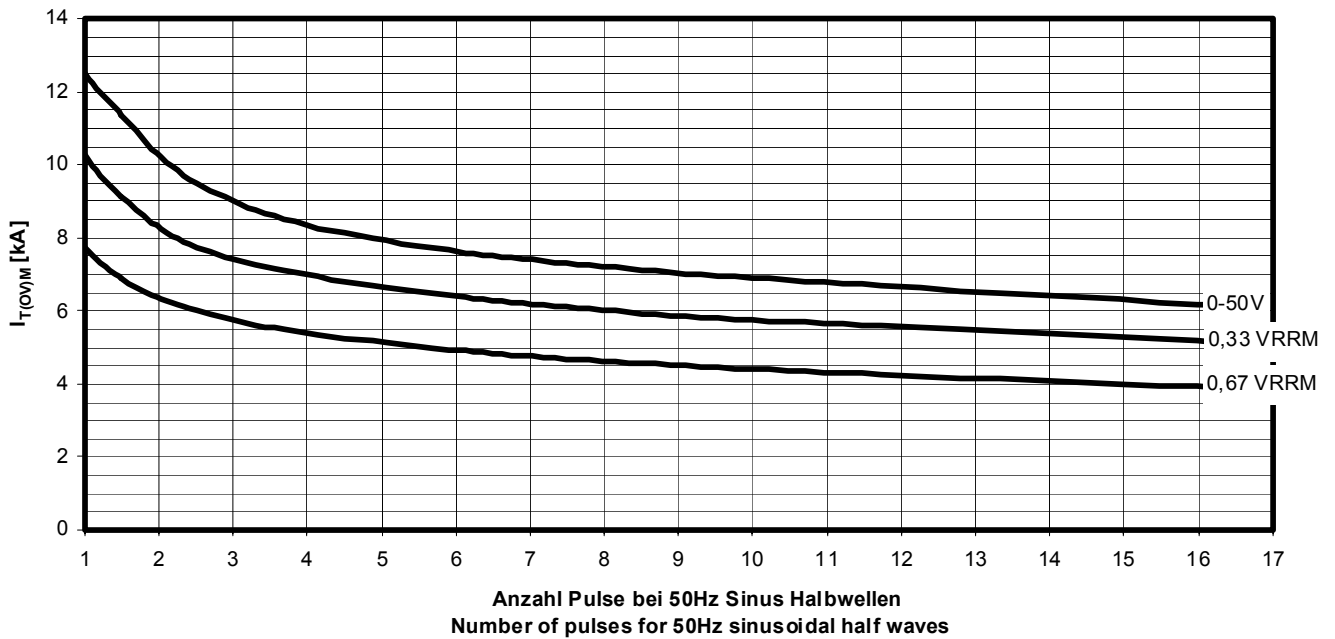
$$T_{vj} = T_{vjmax}, V_R \leq 0,5 V_{RRM}, V_{RM} = 0,8 V_{RRM}$$

Parameter: Durchlassstrom / On-state current i_{TM}



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Typische Abhängigkeit des Grenzstromes $I_{T(OV)M}$ von der Anzahl für eine Folge von Sinus Halbwellen bei 50Hz. Parameter: Rückwärtsspannung V_{RM}
 Typical dependency of maximum overload on-state current $I_{T(OV)M}$ as a number of a sequence of sinusoidal half waves at 50Hz. Parameter: peak reverse voltage V_{RM}
 $I_{T(OV)M} = f(\text{pulses}, V_{RM}) ; T_{vj} = T_{vjmax}$