


**Elektrische Eigenschaften / Electrical properties**  
 Höchstzulässige Werte / Maximum rated values

Periodische Vorwärts- und Rückwärts-Spitzensperrspannung repetitive peak forward off-state and reverse voltages	$T_{vj} = -40^{\circ}\text{C} \dots T_{vj \max}$	$V_{\text{DRM}}, V_{\text{RRM}}$	2200 2400	2600 2800	V V
Vorwärts-Stosspitzensperrspannung non-repetitive peak forward off-state voltage	$T_{vj} = -40^{\circ}\text{C} \dots T_{vj \max}$	$V_{\text{DSM}}$	2200 2400	2600 2800	V V
Rückwärts-Stosspitzensperrspannung non-repetitive peak reverse voltage	$T_{vj} = +25^{\circ}\text{C} \dots T_{vj \max}$	$V_{\text{RSM}}$	2300 2500	2700 2900	V V
Durchlassstrom-Grenzeffektivwert maximum RMS on-state current		$I_{\text{TRMSM}}$		4600	A
Dauergrenzstrom average on-state current	$T_C = 85^{\circ}\text{C}$	$I_{\text{TAVM}}$		2400	A
Dauergrenzstrom average on-state current	$T_C = 55^{\circ}\text{C}, \theta = 180^{\circ}\sin, t_p = 10 \text{ ms}$	$I_{\text{TAVM}}$		3470	A
Durchlaßstrom-Effektivwert RMS on-state current		$I_{\text{TRMS}}$		5460	A
Stossstrom-Grenzwert surge current	$T_{vj} = 25^{\circ}\text{C}, t_p = 10 \text{ ms}$ $T_{vj} = T_{vj \max}, t_p = 10 \text{ ms}$	$I_{\text{TSM}}$		44000 40000	A A
Grenzlastintegral $I^2t$ -value	$T_{vj} = 25^{\circ}\text{C}, t_p = 10 \text{ ms}$ $T_{vj} = T_{vj \max}, t_p = 10 \text{ ms}$	$I^2t$		9680 8000	$10^3 \text{ A}^2\text{s}$ $10^3 \text{ A}^2\text{s}$
Kritische Stromsteilheit critical rate of rise of on-state current	DIN IEC 60747-6 $f = 50 \text{ Hz}, i_{\text{GM}} = 1,6 \text{ A},$ $di_{\text{G}}/dt = 1,6 \text{ A}/\mu\text{s}$	$(di_{\text{T}}/dt)_{\text{cr}}$		150	A/ $\mu\text{s}$
Kritische Spannungssteilheit critical rate of rise of off-state voltage	$T_{vj} = T_{vj \max}, V_{\text{D}} = 0,67 V_{\text{DRM}}$ 5.Kennbuchstabe / 5 <sup>th</sup> letter F	$(dv_{\text{D}}/dt)_{\text{cr}}$		1000	V/ $\mu\text{s}$

## Charakteristische Werte / Characteristic values

Durchlassspannung on-state voltage	$T_{vj} = T_{vj \max}, i_{\text{T}} = 8800 \text{ A}$ $T_{vj} = T_{vj \max}, i_{\text{T}} = 1800 \text{ A}$	$V_{\text{T}}$	max. max.	2,65 1,38	V V
Schleusenspannung threshold voltage	$T_{vj} = T_{vj \max}$	$V_{(\text{TO})}$		1,05	V
Ersatzwiderstand slope resistance	$T_{vj} = T_{vj \max}$	$r_{\text{T}}$		0,154	m $\Omega$
Durchlasskennlinie on-state characteristic $600 \text{ A} \leq i_{\text{T}} \leq 12000 \text{ A}$ $v_{\text{T}} = A + B \cdot i_{\text{T}} + C \cdot \ln(i_{\text{T}} + 1) + D \cdot \sqrt{i_{\text{T}}}$	$T_{vj} = T_{vj \max}$	A= B= C= D=		9,039E-01 1,344E-04 -7,137E-03 6,776E-03	
Zündstrom gate trigger current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12 \text{ V}$	$I_{\text{GT}}$	max.	300	mA
Zündspannung gate trigger voltage	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12 \text{ V}$	$V_{\text{GT}}$	max.	3	V
Nicht zündender Steuerstrom gate non-trigger current	$T_{vj} = T_{vj \max}, V_{\text{D}} = 12 \text{ V}$ $T_{vj} = T_{vj \max}, V_{\text{D}} = 0,5 V_{\text{DRM}}$	$I_{\text{GD}}$	max. max.	10 5	mA mA
Nicht zündende Steuerspannung gate non-trigger voltage	$T_{vj} = T_{vj \max}, V_{\text{D}} = 0,5 V_{\text{DRM}}$	$V_{\text{GD}}$	max.	0,25	V
Haltestrom holding current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12 \text{ V}$	$I_{\text{H}}$	max.	300	mA
Einraststrom latching current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12 \text{ V}, R_{\text{GK}} \geq 10 \Omega$ $i_{\text{GM}} = 1,6 \text{ A}, di_{\text{G}}/dt = 1,6 \text{ A}/\mu\text{s},$ $t_{\text{g}} = 20 \mu\text{s}$	$I_{\text{L}}$	max.	1500	mA
Vorwärts- und Rückwärts-Sperrstrom forward off-state and reverse current	$T_{vj} = T_{vj \max}$ $V_{\text{D}} = V_{\text{DRM}}, V_{\text{R}} = V_{\text{RRM}}$	$i_{\text{D}}, i_{\text{R}}$	max.	250	mA
Zündverzug gate controlled delay time	DIN IEC 60747-6 $T_{vj} = 25^{\circ}\text{C}, i_{\text{GM}} = 1,6 \text{ A},$ $di_{\text{G}}/dt = 1,6 \text{ A}/\mu\text{s}$	$t_{\text{gd}}$	max.	3	$\mu\text{s}$

prepared by:	H.Sandmann	date of publication:	2010-06-23
approved by:	M.Leifeld	revision:	3.1

**N****Datenblatt / Data sheet****Netz-Thyristor  
Phase Control Thyristor****T2160N**Infineon Technologies Bipolar  
GmbH & Co. KG**Elektrische Eigenschaften / Electrical properties**  
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 <sup>th</sup> letter O	$t_q$	typ. 400 $\mu s$
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**Thermische Eigenschaften / Thermal properties**

Innerer Wärmewiderstand thermal resistance, junction to case	<u>Kühlfläche / cooling surface</u> beidseitig / two-sided, $\theta = 180^\circ\text{sin}$ beidseitig / two-sided, DC Anode / anode, $\theta = 180^\circ\text{sin}$ Anode / anode, DC Kathode / cathode, $\theta = 180^\circ\text{sin}$ Kathode / cathode, DC	$R_{thJC}$	max. 0,0085 °C/W max. 0,0078 °C/W max. 0,0152 °C/W max. 0,0146 °C/W max. 0,0183 °C/W max. 0,0169 °C/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	<u>Kühlfläche / cooling surface</u> beidseitig / two-sides einseitig / single-sides	$R_{thCH}$	max. 0,0025 °C/W max. 0,0050 °C/W
Höchstzulässige Sperrschichttemperatur maximum junction temperature		$T_{vj\ max}$	125 °C
Betriebstemperatur operating temperature		$T_{c\ op}$	-40...+125 °C
Lagertemperatur storage temperature		$T_{stg}$	-40...+150 °C

**Mechanische Eigenschaften / Mechanical properties**

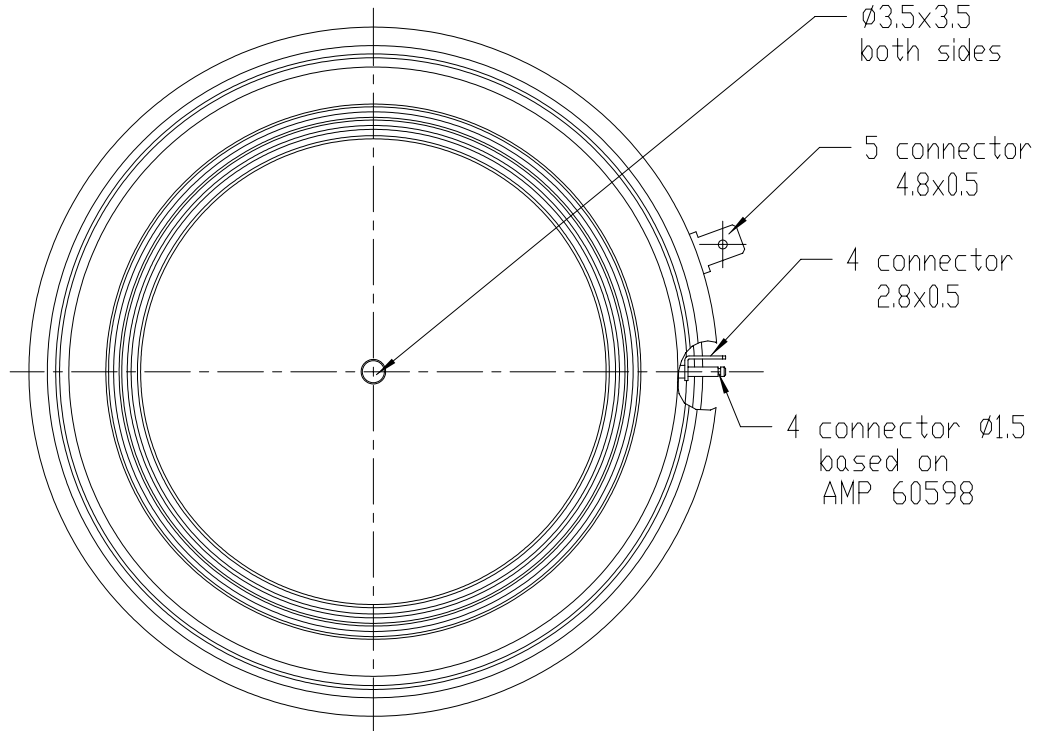
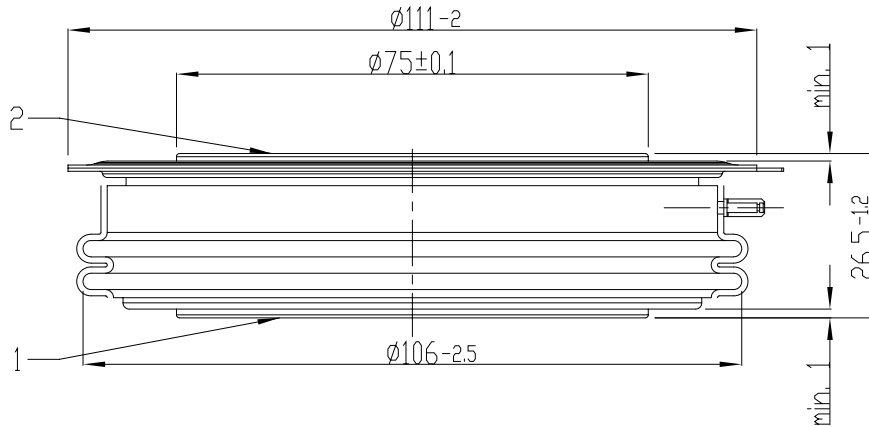
Gehäuse, siehe Anlage case, see annex			Seite 3 page 3
Si-Element mit Druckkontakt Si-pellet with pressure contact			
Anpresskraft clamping force		F	42...95 kN
Steueranschlüsse control terminals	Gate (flat) Gate (round, based on AMP 60598) Kathode / cathode		A 2,8x0,5 mm Ø 1,5 mm A 4,8x0,5 mm
Gewicht weight		G	typ. 1200 g
Kriechstrecke creepage distance			25 mm
Schwingfestigkeit vibration resistance	f = 50 Hz		50 m/s <sup>2</sup>



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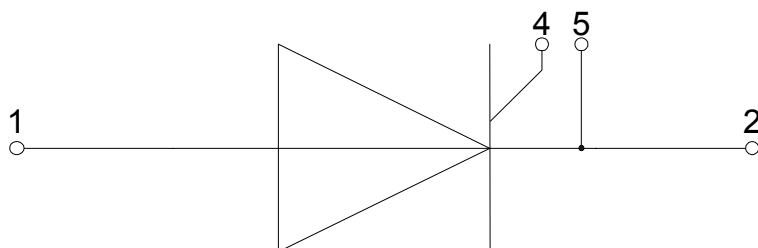
**T2160N**

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strike distance: 15mm  
creepage distance: 25mm

overall height based  
on contact pressure



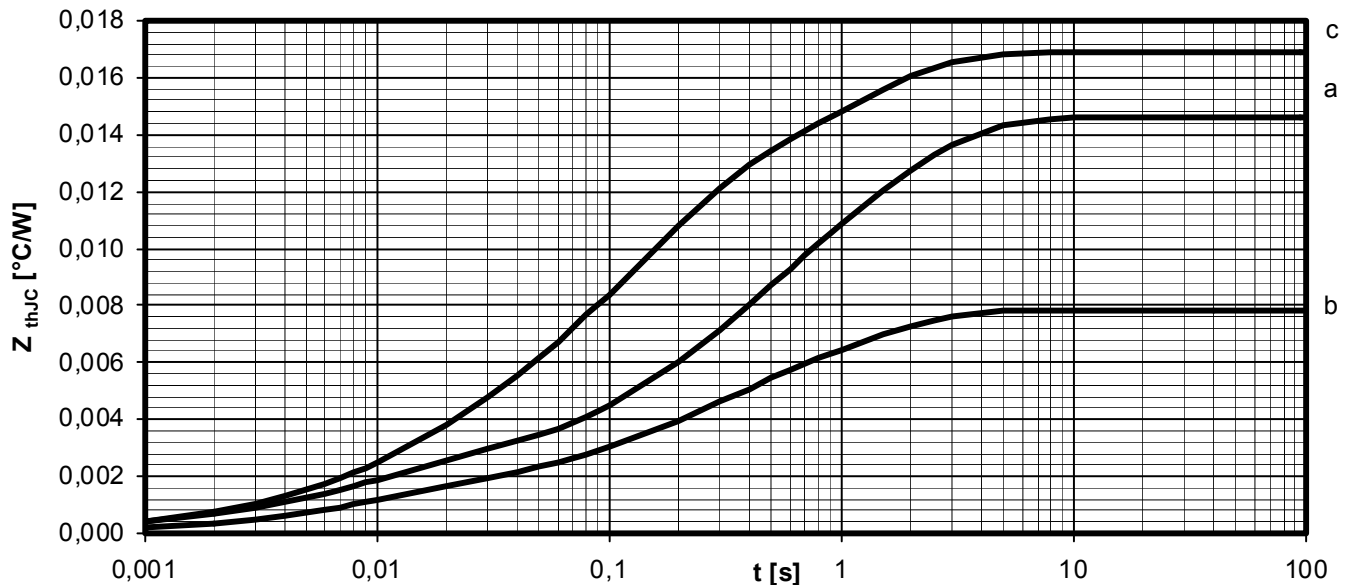
- 1:** Anode / Anode
- 2:** Kathode / Cathode
- 4:** Gate
- 5:** Hilfskathode/  
Auxiliary Cathode


**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]	0,00003	0,00039	0,00123	0,0028	0,00338	-	-
	$\tau_n$ [s]	0,00006	0,00392	0,01520	0,2068	1,09140	-	-
anodenseitig anode-sided	$R_{thn}$ [°C/W]	0,00001	0,00037	0,00190	0,0013	0,00434	0,00668	-
	$\tau_n$ [s]	0,00001	0,00182	0,00951	0,1350	0,34700	1,54000	-
kathodenseitig cathode-sided	$R_{thn}$ [°C/W]	0,00003	0,00073	0,00302	0,00802	0,0051	-	-
	$\tau_n$ [s]	0,00004	0,00341	0,02150	0,13500	1,1100	-	-

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**

$$Z_{thJC} = f(t)$$

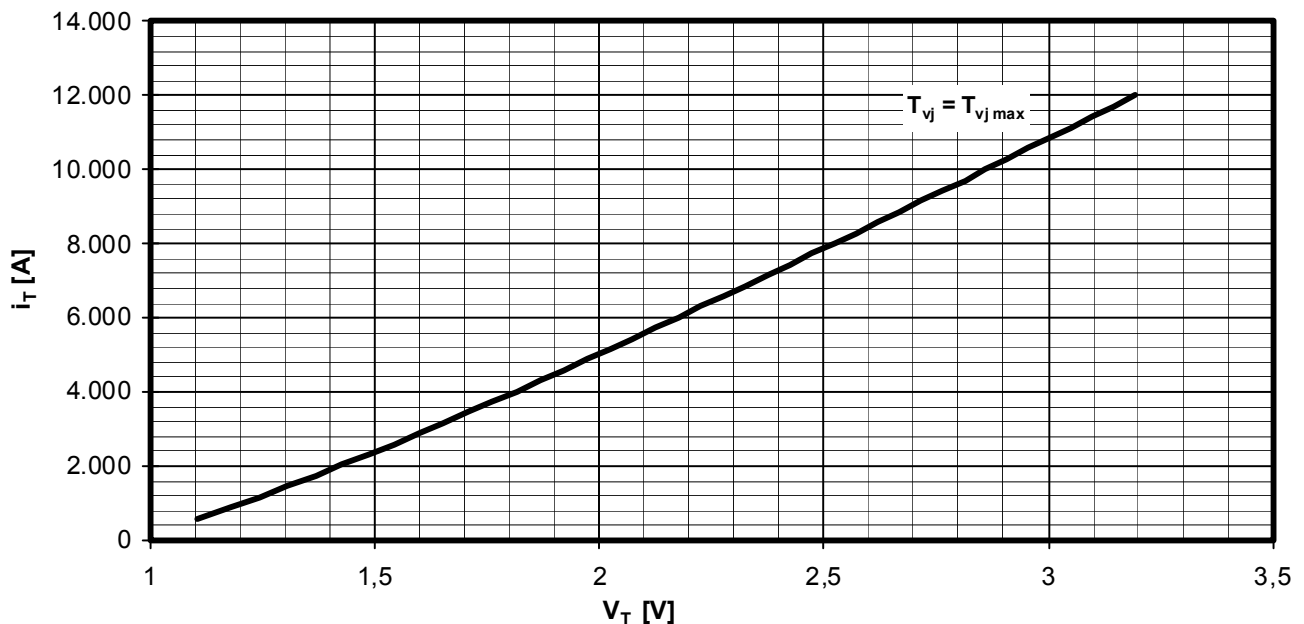
- a - Anodenseitige Kühlung / Anode-sided cooling  
 b - Beidseitige Kühlung / Two-sided cooling  
 c - Kathodenseitige Kühlung / Cathode-sided cooling


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

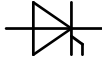
Kühlung / Cooling		$\Theta = 180^\circ$	$\Theta = 120^\circ$	$\Theta = 90^\circ$	$\Theta = 60^\circ$	$\Theta = 30^\circ$
beidseitig two-sided	$\Delta Z_{th \Theta rec}$ [°C/W]	0,00084	0,00130	0,00161	0,00201	0,00259
	$\Delta Z_{th \Theta sin}$ [°C/W]	0,00069	0,00093	0,00120	0,00156	0,00208
anodenseitig anode-sided	$\Delta Z_{th \Theta rec}$ [°C/W]	0,00143	0,00228	0,00288	0,00371	0,00492
	$\Delta Z_{th \Theta sin}$ [°C/W]	0,00112	0,00154	0,00208	0,00289	0,00425
kathodenseitig cathode-sided	$\Delta Z_{th \Theta rec}$ [°C/W]	0,00170	0,00261	0,00322	0,00399	0,00506
	$\Delta Z_{th \Theta sin}$ [°C/W]	0,00144	0,00191	0,00246	0,00321	0,00430

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

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


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

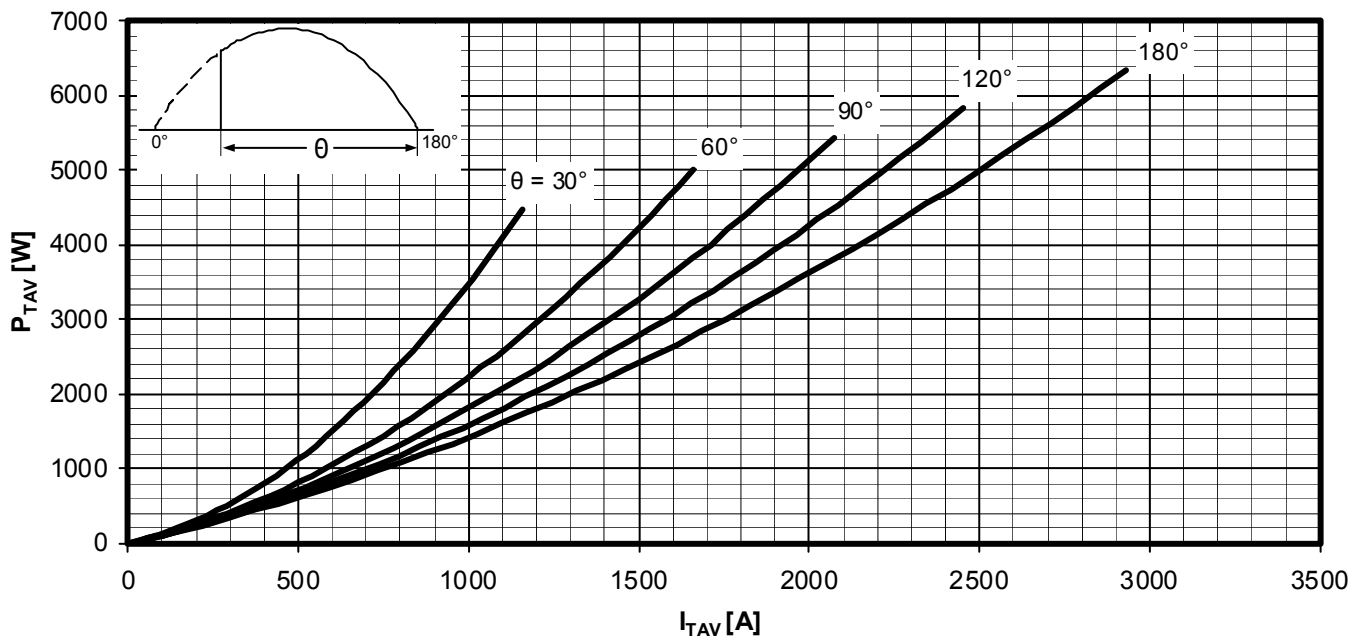
$$T_{vj} = T_{vj max}$$



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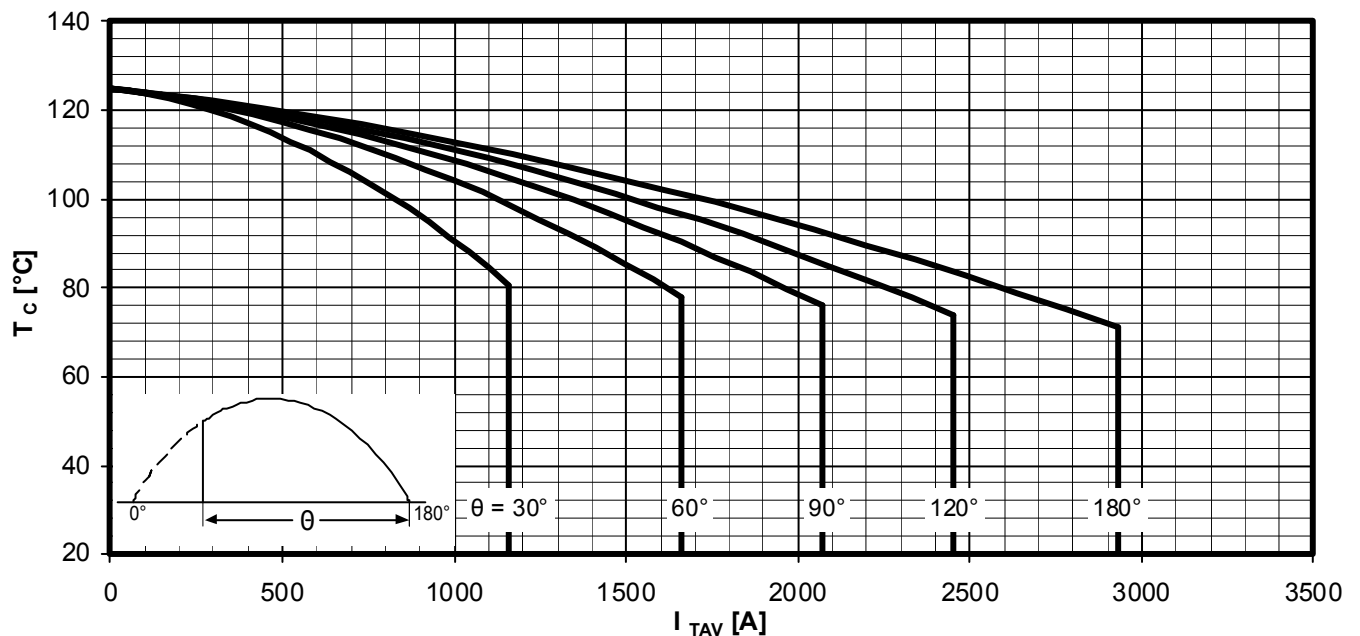
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Durchlassverlustleistung / On-state power loss  $P_{TAV} = f(I_{TAV})$

Sinusförmiger Strom / Sinusoidal current

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

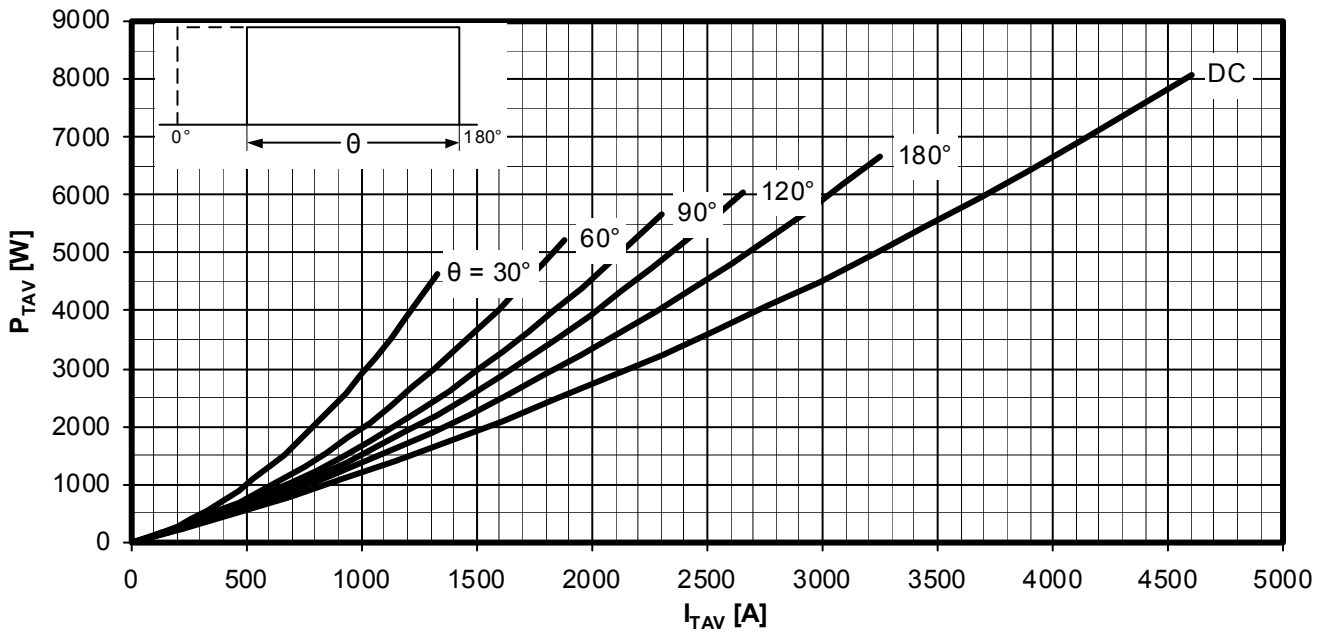


Höchstzulässige Gehäusetemperatur / Maximum allowable case temperature  $T_c = f(I_{TAV})$

Sinusförmiger Strom / Sinusoidal current

Beidseitige Kühlung / Two-sided cooling

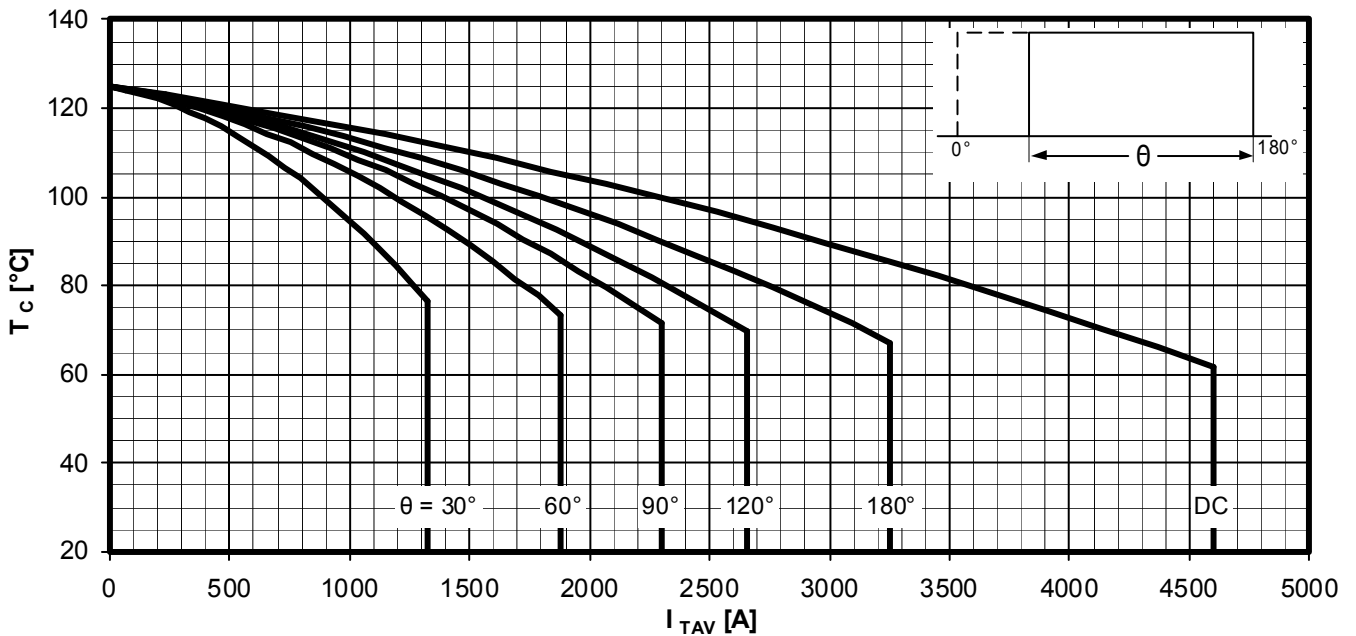
Parameter: Stromflusswinkel  $\Theta$  / Current conduction angle  $\Theta$



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

Rechteckförmiger Strom / Rectangular current

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

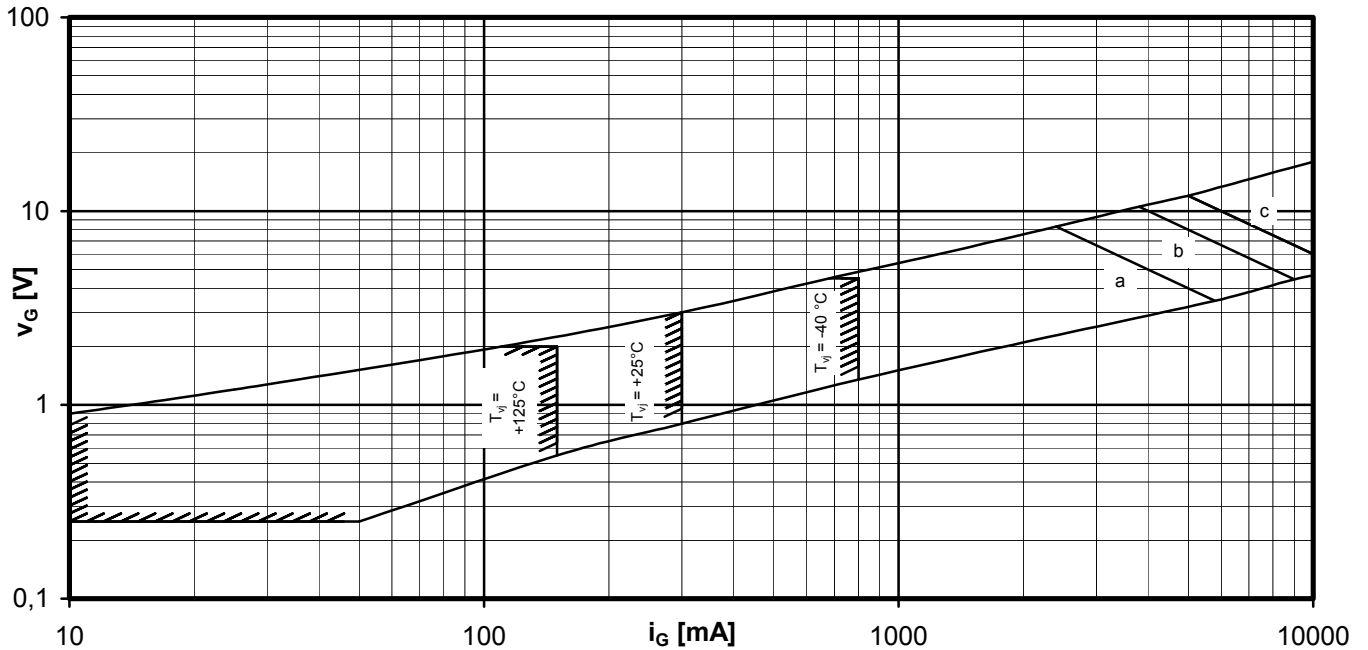


Höchstzulässige Gehäusetemperatur / Maximum allowable case temperature  $T_c = f(I_{TAV})$

Rechteckförmiger Strom / Rectangular current

Beidseitige Kühlung / Two-sided cooling

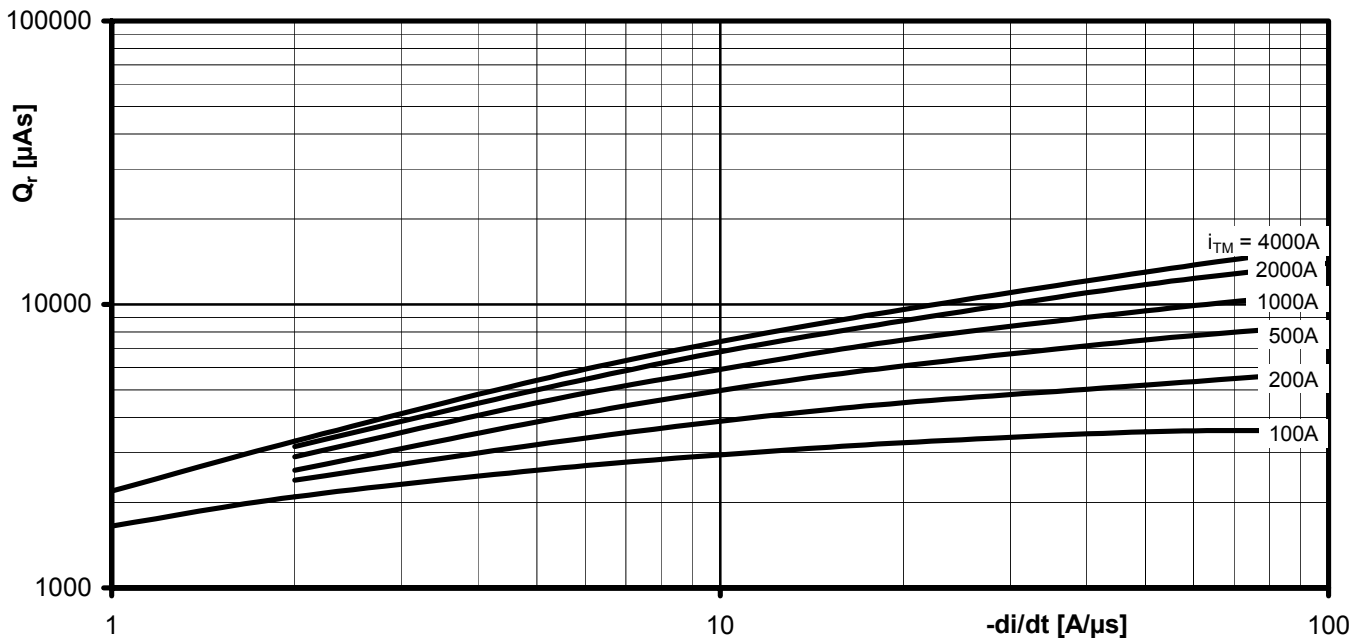
Parameter: Stromflusswinkel  $\Theta$  / Current conduction angle  $\Theta$



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

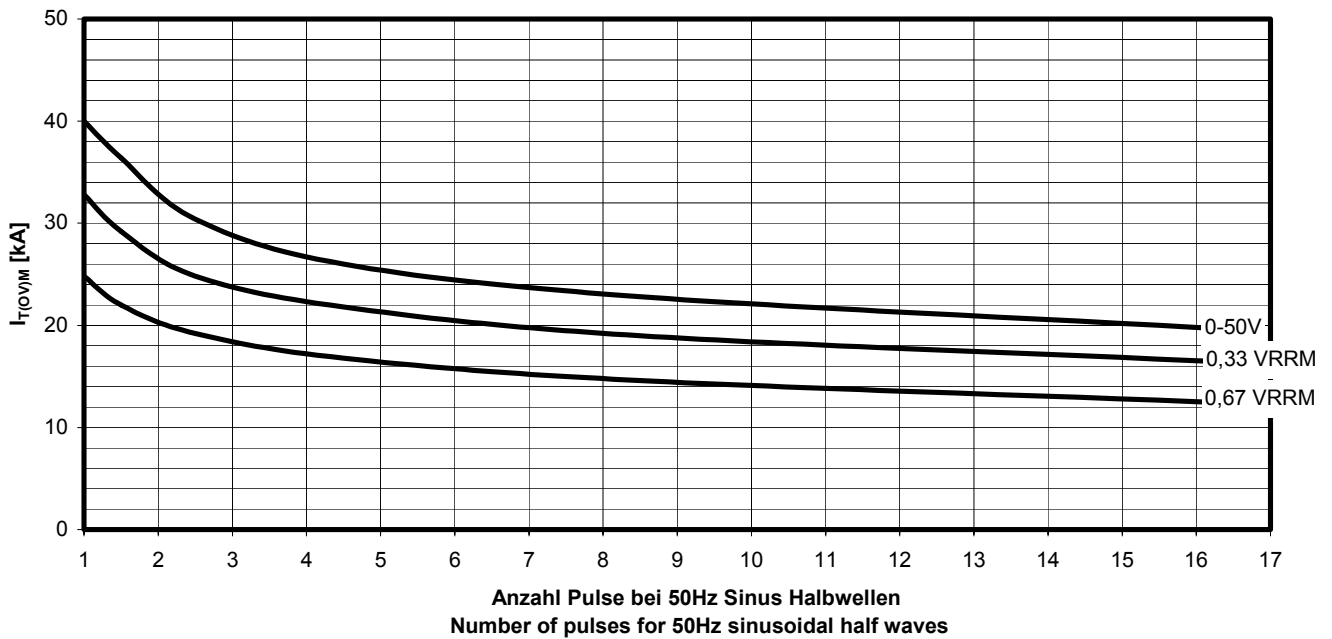


Sperrverzögerungsladung / Recovered charge  $Q_r = f(di/dt)$

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

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





**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  $V_{RM}$**   
 $I_{T(OV)M} = f(\text{pulses}, V_{RM}) ; T_{vj} = T_{vjmax}$