


Netz-Thyristor
Phase Control Thyristor
T1960N
Elektrische Eigenschaften / Electrical properties
 Höchstzulässige Werte / Maximum rated values

Periodische Vorwärts- und Rückwärts-Spitzensperrspannung repetitive peak forward off-state and reverse voltages	$T_{vj} = -40^{\circ}\text{C} \dots T_{vj \text{ max}}$	$V_{\text{DRM}}, V_{\text{RRM}}$	1600 1800	2000 2200	V V
Vorwärts-Stosspitzensperrspannung non-repetitive peak forward off-state voltage	$T_{vj} = -40^{\circ}\text{C} \dots T_{vj \text{ max}}$	V_{DSM}	1600 1800	2000 2200	V V
Rückwärts-Stosspitzensperrspannung non-repetitive peak reverse voltage	$T_{vj} = +25^{\circ}\text{C} \dots T_{vj \text{ max}}$	V_{RSM}	1700 1900	2100 2300	V V
Durchlassstrom-Grenzeffektivwert maximum RMS on-state current		I_{TRMSM}		4100	A
Dauergrenzstrom average on-state current	$T_C = 85^{\circ}\text{C}$	I_{TAVM}		1960	A
Dauergrenzstrom average on-state current	$T_C = 55^{\circ}\text{C}, \theta = 180^{\circ}\text{sin}, t_p = 10 \text{ ms}$	I_{TAVM}		2860	A
Durchlaßstrom-Effektivwert RMS on-state current		I_{TRMS}		4490	A
Stossstrom-Grenzwert surge current	$T_{vj} = 25^{\circ}\text{C}, t_p = 10 \text{ ms}$ $T_{vj} = T_{vj \text{ max}}, t_p = 10 \text{ ms}$	I_{TSM}		40000 35000	A A
Grenzlastintegral I^2t -value	$T_{vj} = 25^{\circ}\text{C}, t_p = 10 \text{ ms}$ $T_{vj} = T_{vj \text{ max}}, t_p = 10 \text{ ms}$	I^2t		8000 6125	$10^3 \text{ A}^2\text{s}$ $10^3 \text{ A}^2\text{s}$
Kritische Stromsteilheit critical rate of rise of on-state current	DIN IEC 60747-6 $f = 50 \text{ Hz}, i_{\text{GM}} = 1,6 \text{ A},$ $di_{\text{G}}/dt = 1,6 \text{ A}/\mu\text{s}$	$(di_{\text{T}}/dt)_{\text{cr}}$		200	$\text{A}/\mu\text{s}$
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	$\text{V}/\mu\text{s}$

Charakteristische Werte / Characteristic values

Durchlassspannung on-state voltage	$T_{vj} = T_{vj \text{ max}}, i_{\text{T}} = 8 \text{ kA}$ $T_{vj} = T_{vj \text{ max}}, i_{\text{T}} = 2 \text{ kA}$	V_{T}	max. max.	2,1 1,2	V V
Schleusenspannung threshold voltage	$T_{vj} = T_{vj \text{ max}}$	$V_{(\text{TO})}$		0,9	V
Ersatzwiderstand slope resistance	$T_{vj} = T_{vj \text{ max}}$	r_{T}		0,15	$\text{m}\Omega$
Durchlasskennlinie $500 \text{ A} \leq i_{\text{T}} \leq 9500 \text{ A}$ on-state characteristic $v_{\text{T}} = A + B \cdot i_{\text{T}} + C \cdot \ln(i_{\text{T}} + 1) + D \cdot \sqrt{i_{\text{T}}}$	$T_{vj} = T_{vj \text{ max}}$	A= B= C= D=		1,363E+00 5,600E-05 -1,358E-01 1,694E-02	
Zündstrom gate trigger current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12 \text{ V}$	I_{GT}	max.	300	mA
Zündspannung gate trigger voltage	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12 \text{ V}$	V_{GT}	max.	2,5	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.	0,25	V
Haltestrom holding current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12 \text{ V}$	I_{H}	max.	300	mA
Einraststrom latching current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12 \text{ V}, R_{\text{GK}} \geq 10 \Omega$ $i_{\text{GM}} = 1,6 \text{ A}, di_{\text{G}}/dt = 1,6 \text{ A}/\mu\text{s},$ $t_{\text{g}} = 20 \mu\text{s}$	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.	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_{gd}	max.	4	μs

prepared by:	H.Sandmann	date of publication:	2009-03-12
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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. 300	μs
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Thermische Eigenschaften / Thermal properties

Innerer Wärmewiderstand thermal resistance, junction to case	<u>Kühlfläche / cooling surface</u> beidseitig / two-sided, $\theta = 180^\circ\ sin$ 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. 0,0125 max. 0,0117 max. 0,0232 max. 0,0225 max. 0,0250 max. 0,0245	$^\circ C/W$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$ $^\circ C/W$
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	<u>Kühlfläche / cooling surface</u> beidseitig / two-sides einseitig / single-sides	R_{thCH}	max. 0,0030 max. 0,0060	$^\circ C/W$ $^\circ C/W$
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	$^\circ C$

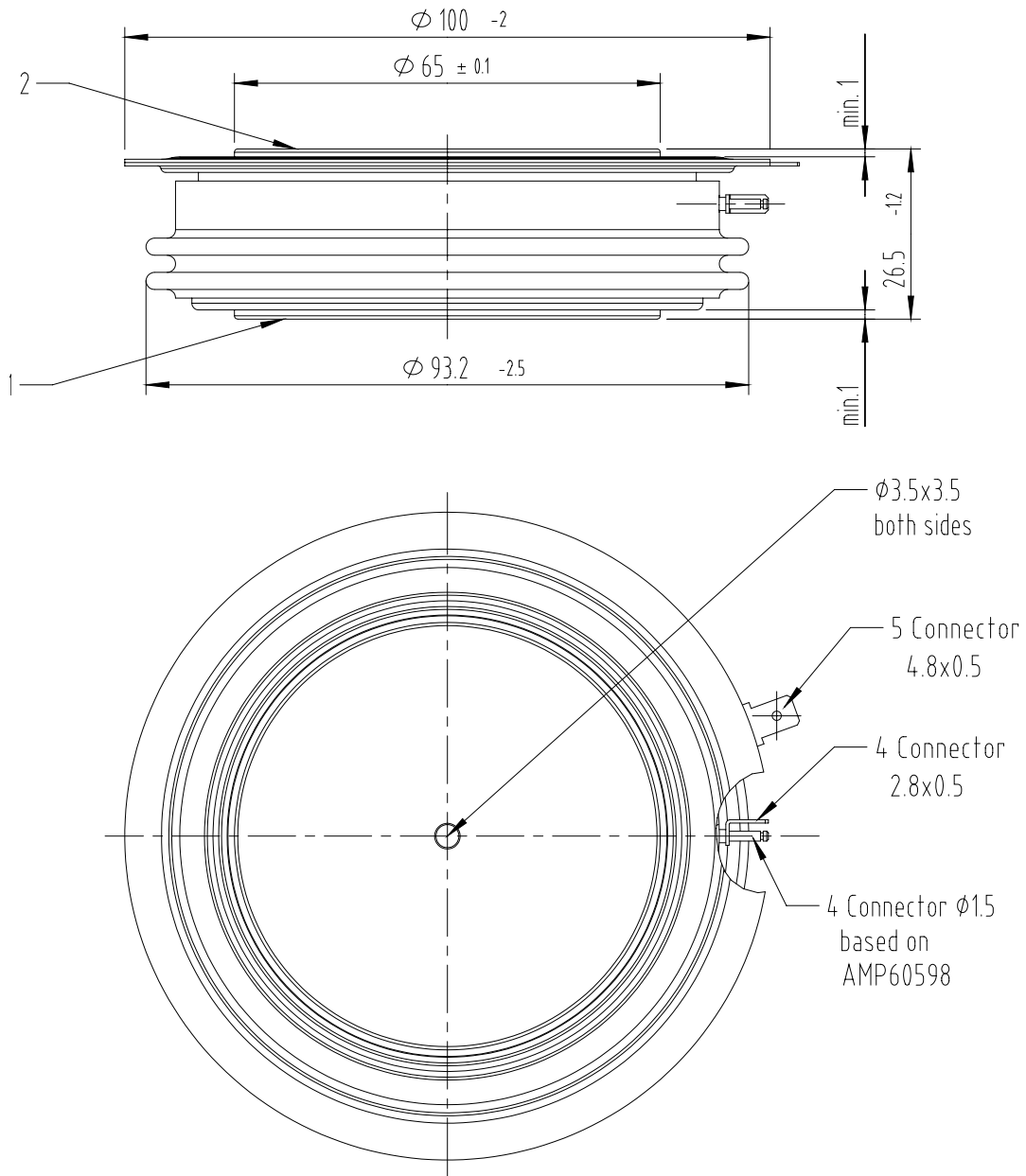
Mechanische Eigenschaften / Mechanical properties

Gehäuse, siehe Anlage case, see annex			Seite 3 page 3	
Si-Element mit Druckkontakt Si-pellet with pressure contact				
Anpresskraft clamping force		F	30...65	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. 900	g
Kriechstrecke creepage distance			25	mm
Schwingfestigkeit vibration resistance	f = 50 Hz		50	m/s ²



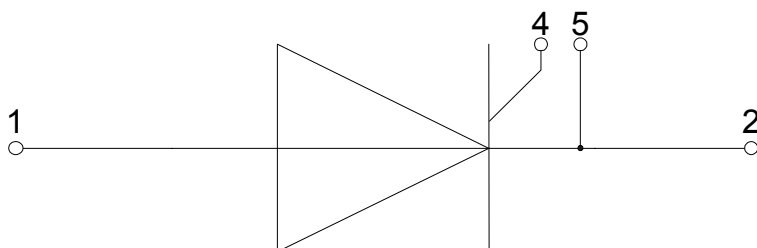
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strike distance: 15mm
creepage distance: 25mm

overall height based
on contact pressure



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



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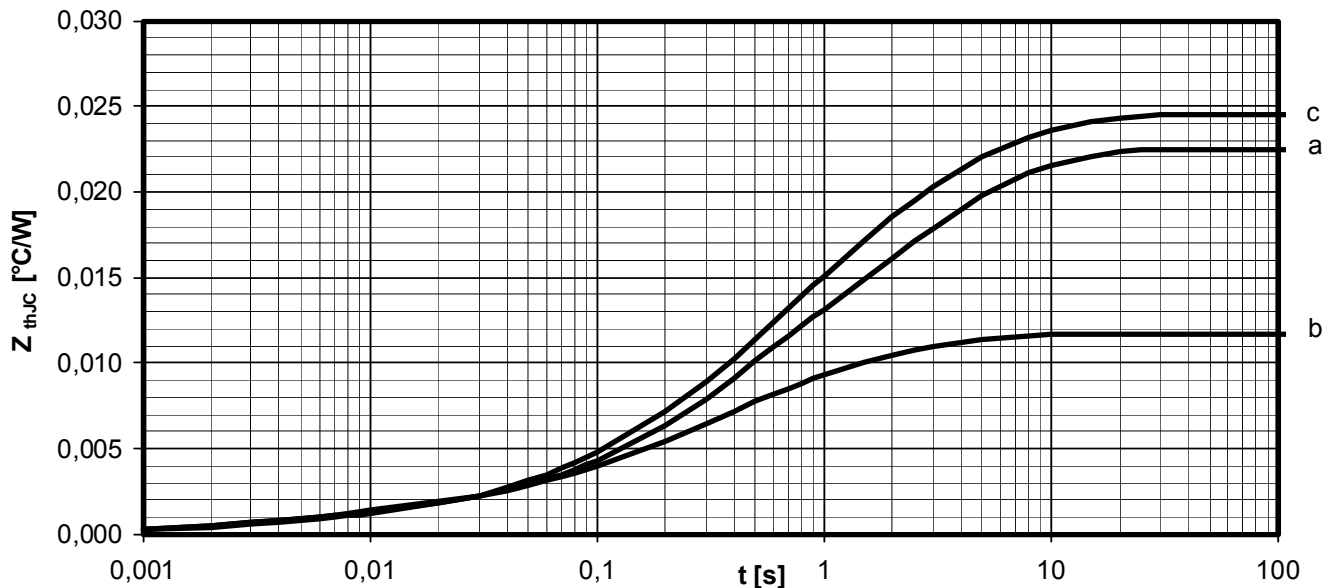
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Analytische Elemente des transienten Wärmewiderstandes Z_{thJC} für DC
Analytical elements of transient thermal impedance Z_{thJC} for DC

Kühlung / Cooling	Pos. n	1	2	3	4	5	6	7
beidseitig two-sided	R_{thn} [°C/W]	0,00003	0,00057	0,00091	0,00274	0,00425	0,00319	-
	τ_n [s]	0,00029	0,00298	0,01350	0,13400	0,44900	2,05000	-
anodenseitig anode-sided	R_{thn} [°C/W]	0,00004	0,0006	0,00105	0,0076	0,0085	0,00472	-
	τ_n [s]	0,00029	0,0023	0,02400	0,3100	1,9000	6,10000	-
kathodenseitig cathode-sided	R_{thn} [°C/W]	0,00004	0,0006	0,00205	0,00805	0,009	0,00477	-
	τ_n [s]	0,00029	0,0030	0,05700	0,38000	1,570	6,10000	-

Analytische Funktion / Analytical function:

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



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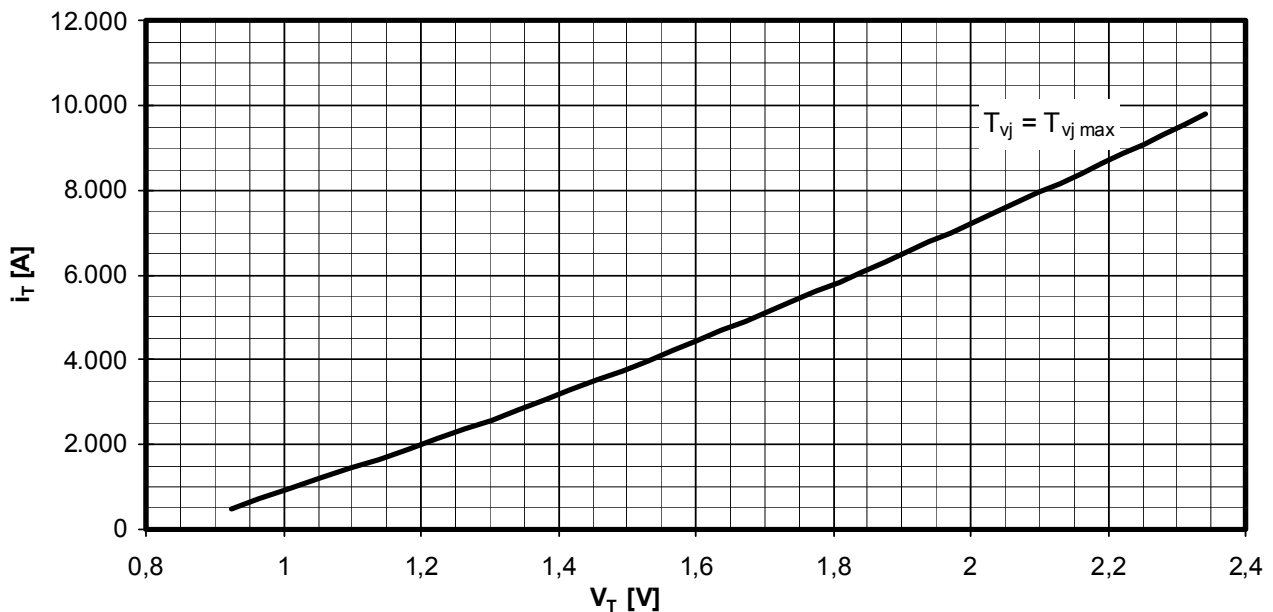
Erhöhung des $Z_{th DC}$ bei Sinus und Rechteckströmen mit unterschiedlichen Stromflusswinkeln Θ
Rise of $Z_{th DC}$ for sinewave and rectangular current with different current conduction angles Θ

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

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]	0,00105	0,00170	0,00218	0,00281	0,00376
	$\Delta Z_{th \Theta sin}$ [°C/W]	0,00080	0,00112	0,00154	0,00214	0,00315
anodenseitig anode-sided	$\Delta Z_{th \Theta rec}$ [°C/W]	0,00098	0,00166	0,00220	0,00298	0,00422
	$\Delta Z_{th \Theta sin}$ [°C/W]	0,00064	0,00096	0,00140	0,00212	0,00345
kathodenseitig cathode-sided	$\Delta Z_{th \Theta rec}$ [°C/W]	0,00091	0,00150	0,00194	0,00254	0,00346
	$\Delta Z_{th \Theta sin}$ [°C/W]	0,00067	0,00095	0,00133	0,00189	0,00286

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

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



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

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