**Netz-Thyristor-Modul**
Phase Control Thyristor Module**TT92N**

TT92N

TT92N..K...K

TD92N

TD92N..K...A

DT92N

NT92N

Elektrische Eigenschaften / Electrical properties

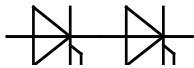
Höchstzulässige Werte / Maximum rated values

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	V V
Vorwärts-Stoßspitzensperrspannung non-repetitive peak forward off-state voltage	$T_{vj} = -40^{\circ}\text{C} \dots T_{vj\text{ max}}$	V_{DSM}	1200	1400 1600	V V
Rückwärts-Stoßspitzensperrspannung non-repetitive peak reverse voltage	$T_{vj} = +25^{\circ}\text{C} \dots T_{vj\text{ max}}$	V_{RSM}	1300	1500 1700	V V
Durchlaßstrom-Grenzeffektivwert maximum RMS on-state current		I_{TRMSM}		160	A
Dauergrenzstrom average on-state current	$T_C = 85^{\circ}\text{C}$ $T_C = 76^{\circ}\text{C}$	I_{TAVM}		92 104	A 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}		2050 1800	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		21000 16200	A ² s A ² s
Kritische Stromsteilheit critical rate of rise of on-state current	DIN IEC 747-6 $f = 50\text{ Hz}$, $i_{\text{GM}} = 0,6\text{ A}$, $di_{\text{G}}/dt = 0,6\text{ A}/\mu\text{s}$	$(di_{\text{T}}/dt)_{\text{cr}}$		150	A/ μs
Kritische Spannungssteilheit critical rate of rise of off-state voltage	$T_{vj} = T_{vj\text{ max}}, V_{\text{D}} = 0,67 V_{\text{DRM}}$ 6.Kennbuchstabe / 6 th letter F	$(dv_{\text{D}}/dt)_{\text{cr}}$		1000	V/ μs

Charakteristische Werte / Characteristic values

Durchlaßspannung on-state voltage	$T_{vj} = T_{vj\text{ max}}, i_{\text{T}} = 300\text{ A}$	v_{T}	max.	1,62	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}		2,15	m Ω
Zündstrom gate trigger current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6\text{ V}$	I_{GT}	max.	120	mA
Zündspannung gate trigger voltage	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6\text{ V}$	V_{GT}	max.	1,4	V
Nicht zündender Steuerstrom gate non-trigger current	$T_{vj} = T_{vj\text{ max}}, V_{\text{D}} = 6\text{ V}$ $T_{vj} = T_{vj\text{ max}}, V_{\text{D}} = 0,5 V_{\text{DRM}}$	I_{GD}	max. max.	5,0 2,5	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	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6\text{ V}, R_{\text{A}} = 5\text{ }\Omega$	I_{H}	max.	200	mA
Einraststrom latching current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6\text{ V}, R_{\text{GK}} \geq 10\text{ }\Omega$ $i_{\text{GM}} = 0,6\text{ A}$, $di_{\text{G}}/dt = 0,6\text{ A}/\mu\text{s}$, $t_{\text{g}} = 20\text{ }\mu\text{s}$	I_{L}	max.	620	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.	25	mA
Zündverzug gate controlled delay time	DIN IEC 747-6 $T_{vj} = 25^{\circ}\text{C}$, $i_{\text{GM}} = 0,6\text{ A}$, $di_{\text{G}}/dt = 0,6\text{ A}/\mu\text{s}$	t_{gd}	max.	3	μs

prepared by:	C.Drilling	date of publication:	09.07.02
approved by:	J. Novotny	revision:	3

**Netz-Thyristor-Modul**
Phase Control Thyristor Module**TT92N****Elektrische Eigenschaften / Electrical properties**

Charakteristische Werte / Characteristic values

Freiwerdezeit circuit commutated turn-off time	$T_{vj} = T_{vj \max}$, $i_{TM} = I_{TAVM}$ $V_{RM} = 100 \text{ V}$, $V_{DM} = 0,67 V_{DRM}$ $dv_D/dt = 20 \text{ V}/\mu\text{s}$, $-di_T/dt = 10 \text{ A}/\mu\text{s}$ 5. Kennbuchstabe / 5 th letter O	t_q	typ.	150	μs
Isolations-Prüfspannung insulation test voltage	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$ RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ sec}$	V_{ISOL}		2,5 3,0	kV kV

Thermische Eigenschaften / Thermal properties

Innerer Wärmewiderstand thermal resistance, junction to case	pro Modul / per Module, $\Theta = 180^\circ \sin$ pro Zweig / per arm, $\Theta = 180^\circ \sin$ pro Modul / per Module, DC pro Zweig / per arm, DC	R_{thJC}	max.	0,185	$^\circ\text{C}/\text{W}$
			max.	0,370	$^\circ\text{C}/\text{W}$
			max.	0,175	$^\circ\text{C}/\text{W}$
			max.	0,350	$^\circ\text{C}/\text{W}$
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per Module pro Zweig / per arm	R_{thCH}	max.	0,05	$^\circ\text{C}/\text{W}$
			max.	0,10	$^\circ\text{C}/\text{W}$
Höchstzulässige Sperrschichttemperatur maximum junction temperature		$T_{vj \max}$		130	$^\circ\text{C}$
Betriebstemperatur operating temperature		$T_{c \text{ op}}$		-40...+130	$^\circ\text{C}$
Lagertemperatur storage temperature		T_{stg}		-40...+130	$^\circ\text{C}$

Mechanische Eigenschaften / Mechanical properties

Gehäuse, siehe Anlage case, see annex				Seite 3 page 3	
Si-Element mit Druckkontakt Si-pellet with pressure contact					
Innere Isolation internal insulation				AIN	
Anzugsdrehmoment für mechanische Anschlüsse mounting torque	Toleranz / Tolerance $\pm 15\%$	M1		4	Nm
Anzugsdrehmoment für elektrische Anschlüsse terminal connection torque	Toleranz / Tolerance $\pm 10\%$	M2		4	Nm
Steueranschlüsse control terminals	DIN 46 244			A 2,8 x 0,8	
Gewicht weight		G	typ.	160	g
Kriechstrecke creepage distance				12,5	mm
Schwingfestigkeit vibration resistance	$f = 50 \text{ Hz}$			50	m/s^2
	file-No.			E 83336	

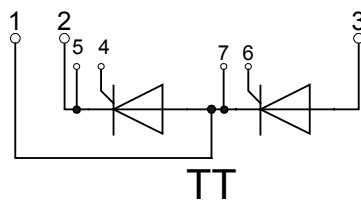
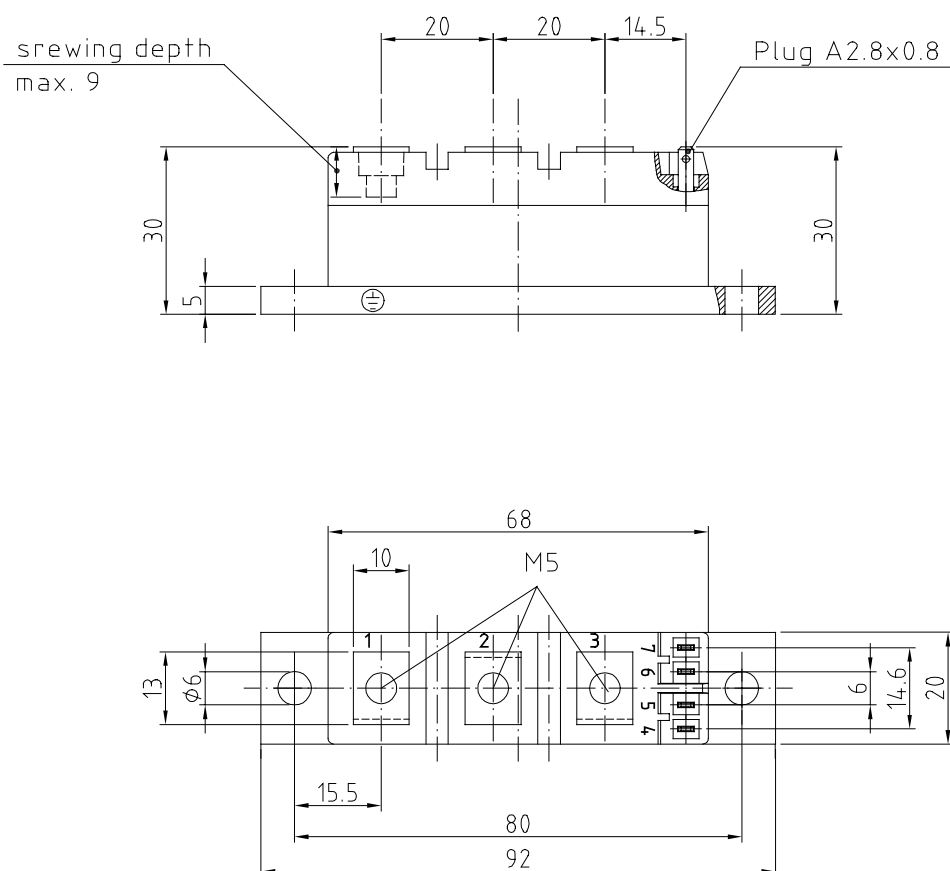
Mit diesem Datenblatt werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert. Es gilt in Verbindung mit den zugehörigen technischen Erläuterungen.

This data sheet specifies semiconductor devices, but promises no characteristics. It is valid in combination with the belonging technical notes.

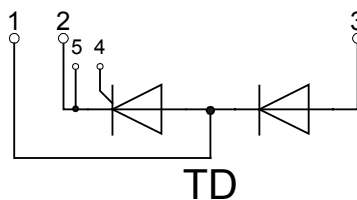
Netz-Thyristor-Modul

Phase Control Thyristor Module

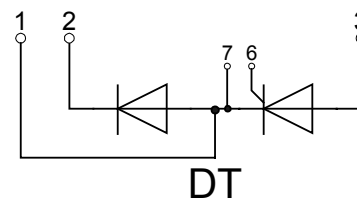
TT92N



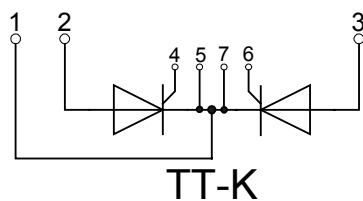
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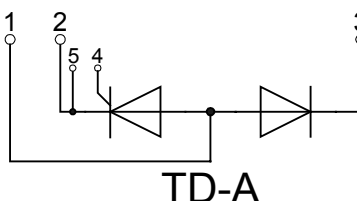
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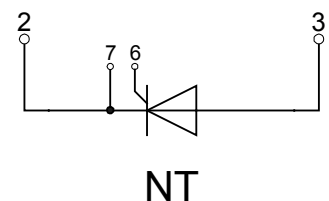
DT



TT-K



TD-A



NT



Netz-Thyristor-Modul
Phase Control Thyristor Module

TT92N

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
$R_{thn} [^{\circ}C/W]$	0,005	0,0195	0,0518	0,128	0,146		
$\tau_n [s]$	0,00004	0,00223	0,022	0,235	1,24		

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
Kühler / Heatsink type: KM14 (50W)

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

Pos. n	1	2	3	4	5	6	7
$R_{thn} [^{\circ}C/W]$	0,007	0,141	0,119	2,133			
$\tau_n [s]$	0,701	4,72	42,5	910			

Verstärkte Kühlung / Forced cooling
3 Module pro Kühlkörper / 3 modules per heatsink
Kühler / Heatsink type: KM14 (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
$R_{thn} [^{\circ}C/W]$	0,007	0,141	0,119	0,583			
$\tau_n [s]$	0,701	4,72	42,5	249			

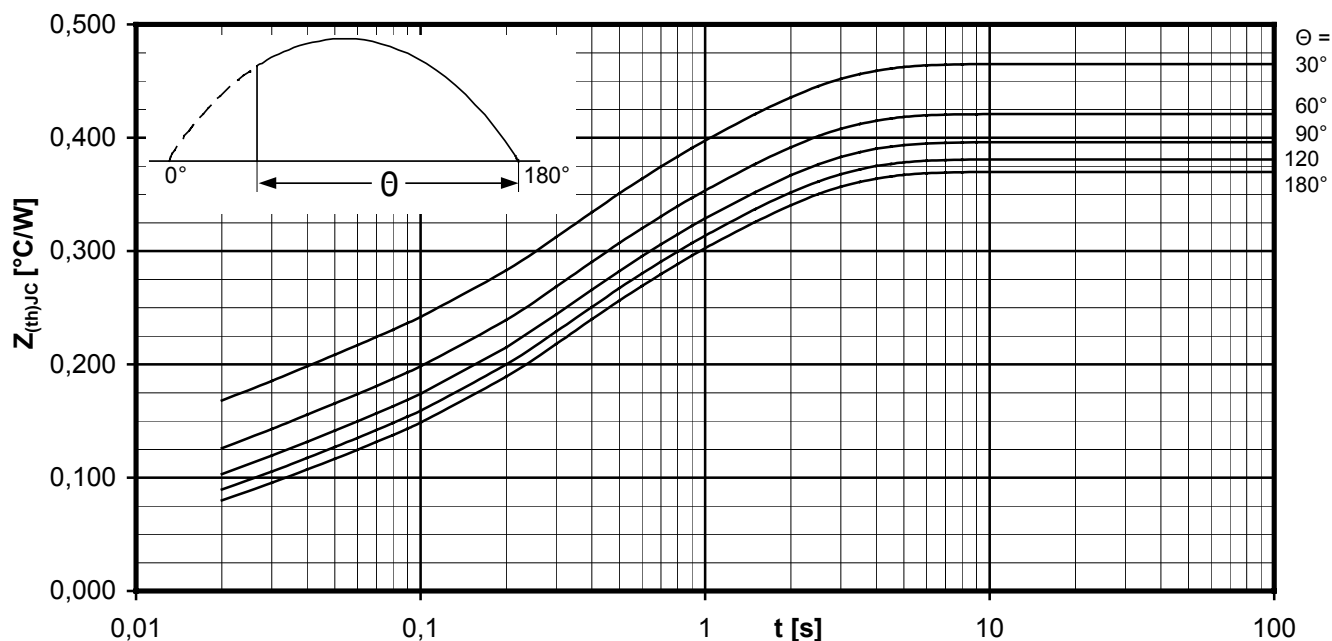
Analytische Funktion / Analytical function:

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



Netz-Thyristor-Modul
Phase Control Thyristor Module

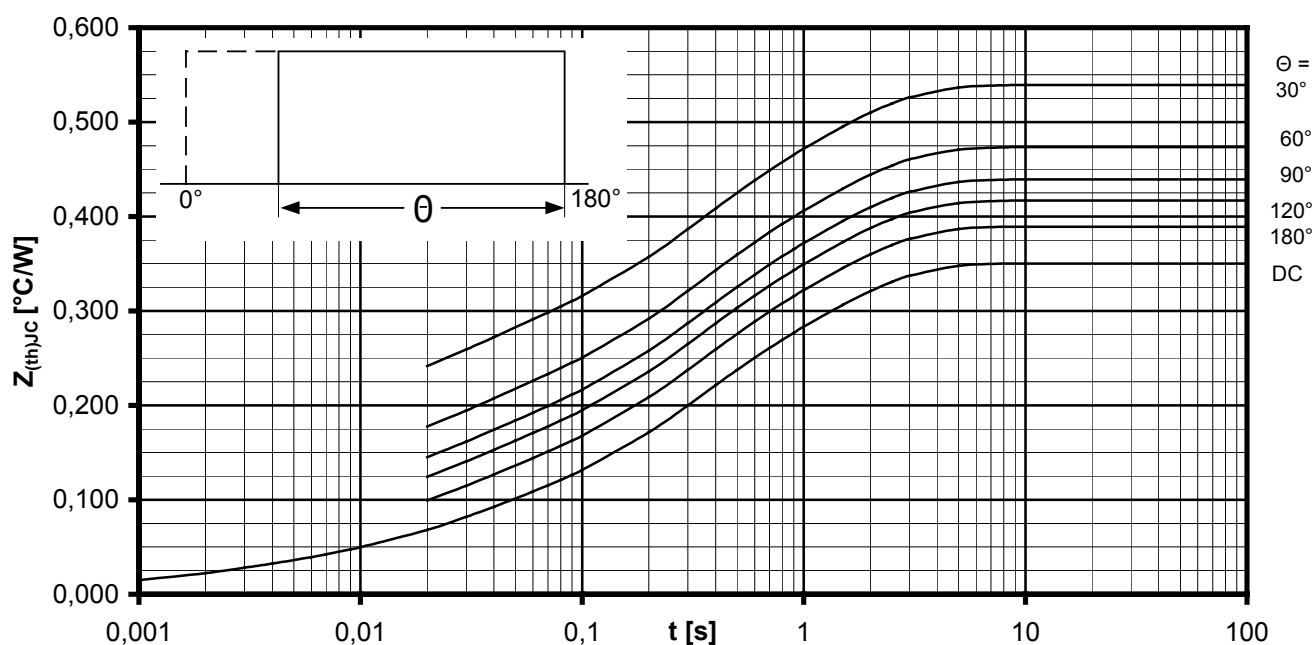
TT92N



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

Sinusförmiger Strom / Sinusoidal current

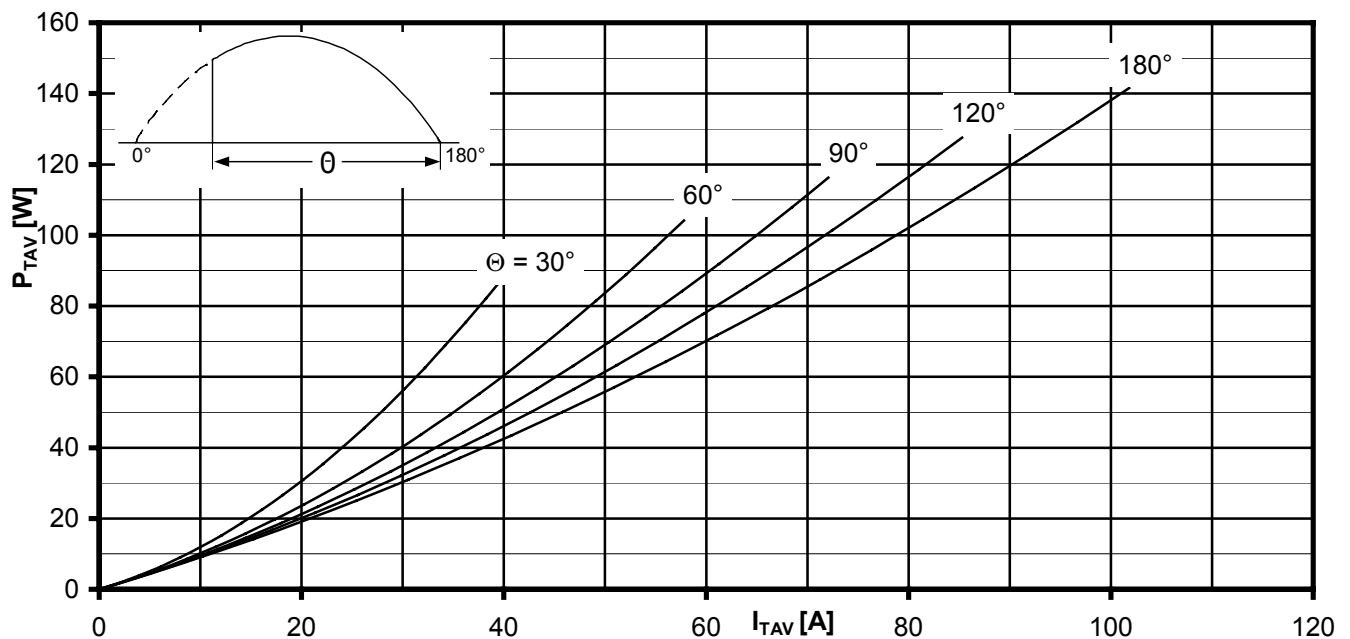
Parameter: Stromflußwinkel Θ / Current conduction angle Θ



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

Rechteckförmiger Strom / Rectangular current

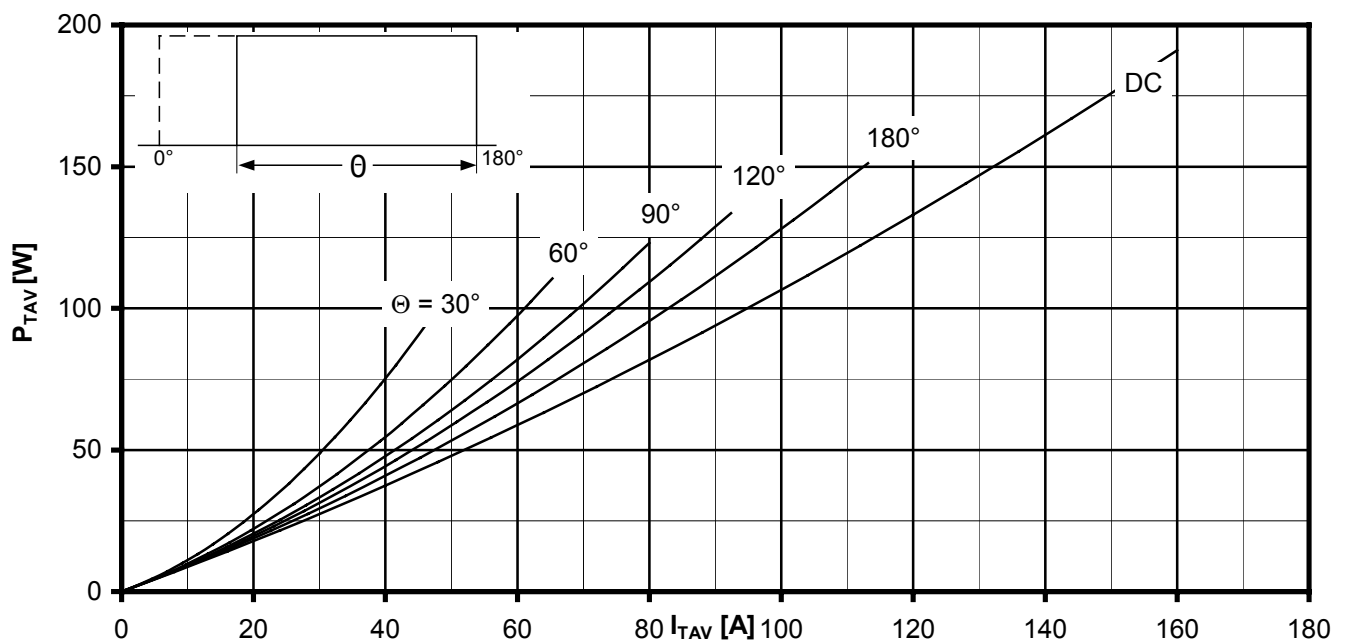
Parameter: Stromflußwinkel Θ / Current conduction angle Θ


Netz-Thyristor-Modul
Phase Control Thyristor Module
TT92N

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 Θ



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

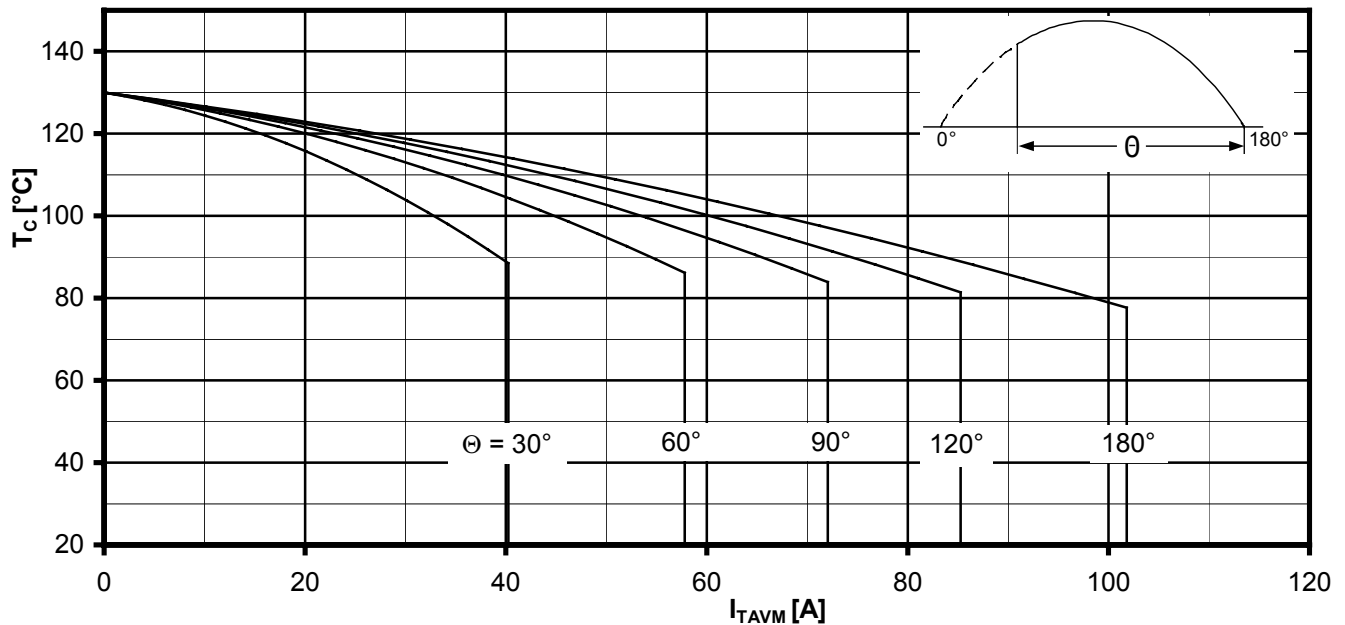
Rechteckförmiger Strom / Rectangular current Strombelastung je Zweig / Current load per arm

Parameter: Stromflußwinkel / Current conduction angle Θ



Netz-Thyristor-Modul
Phase Control Thyristor Module

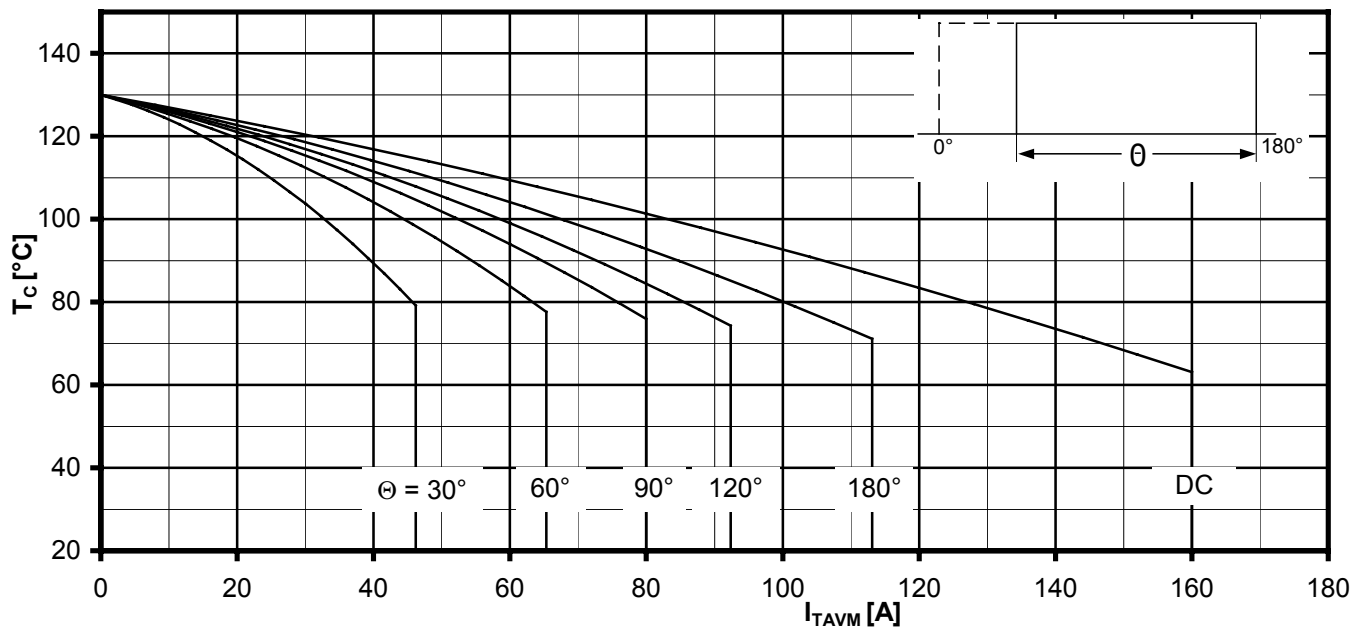
TT92N



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

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

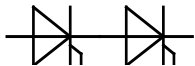
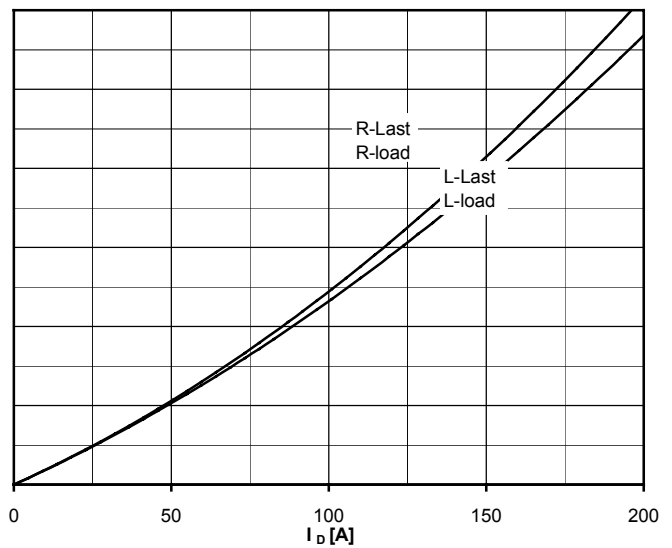
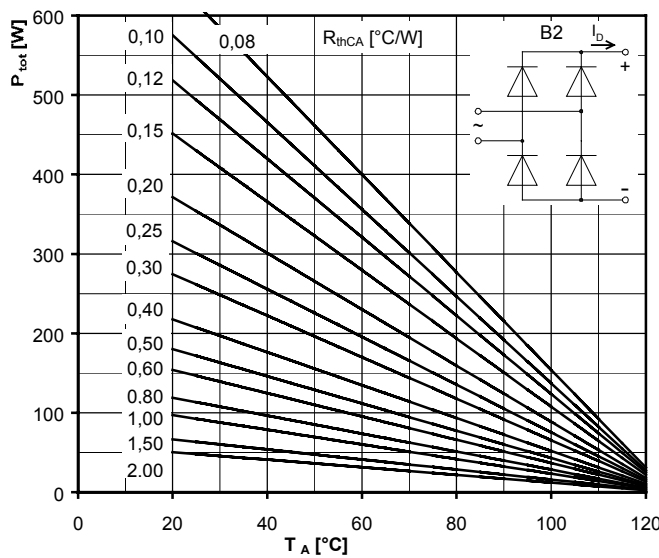
Parameter: Stromflußwinkel Θ / Current conduction angle Θ



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

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

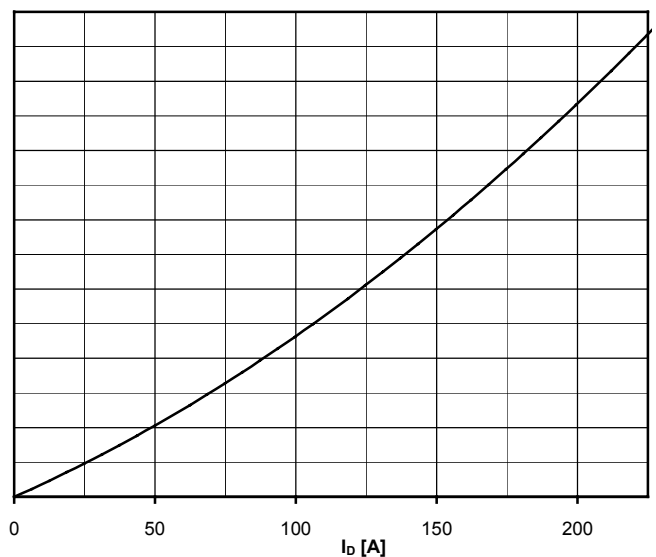
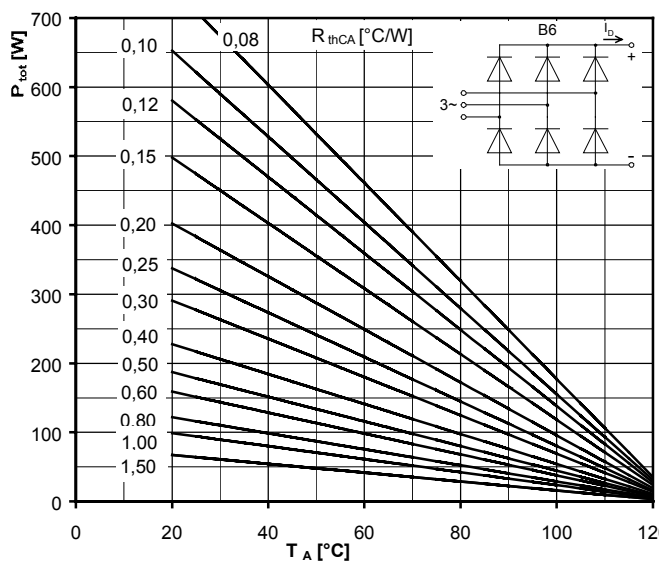
Parameter: Stromflußwinkel Θ / Current conduction angle Θ

**Netz-Thyristor-Modul**
Phase Control Thyristor Module**TT92N****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:

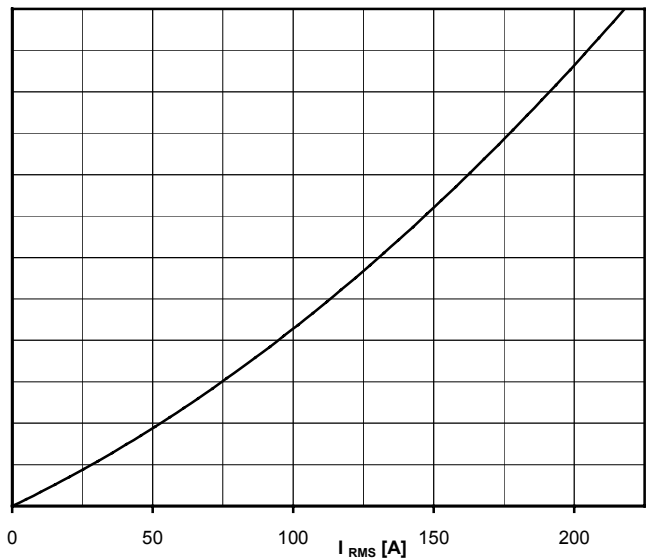
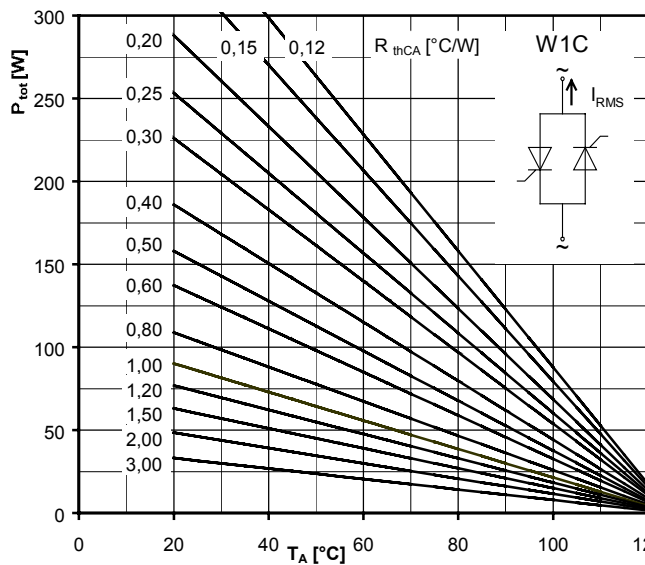
Wärmewiderstand zwischen den Gehäusen und Umgebung / Thermal resistance cases to ambient R_{thCA} **Höchstzulässiger Ausgangsstrom / Maximum rated output current I_D**

B6- Sechspuls-Brückenschaltung / Six-pulse bridge circuit

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

Parameter:

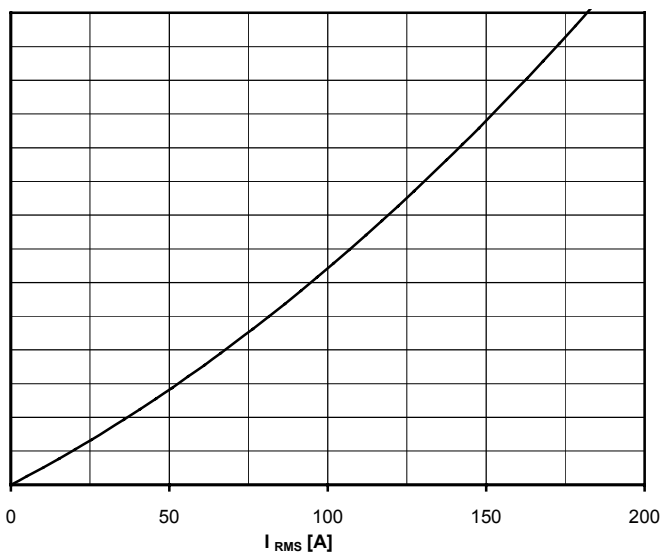
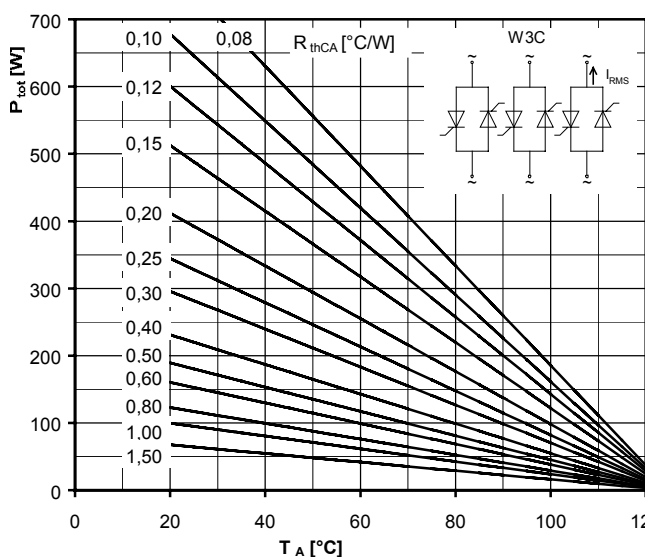
Wärmewiderstand zwischen den Gehäusen und Umgebung / Thermal resistance cases to ambient R_{thCA}

**Netz-Thyristor-Modul**
Phase Control Thyristor Module**TT92N****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}

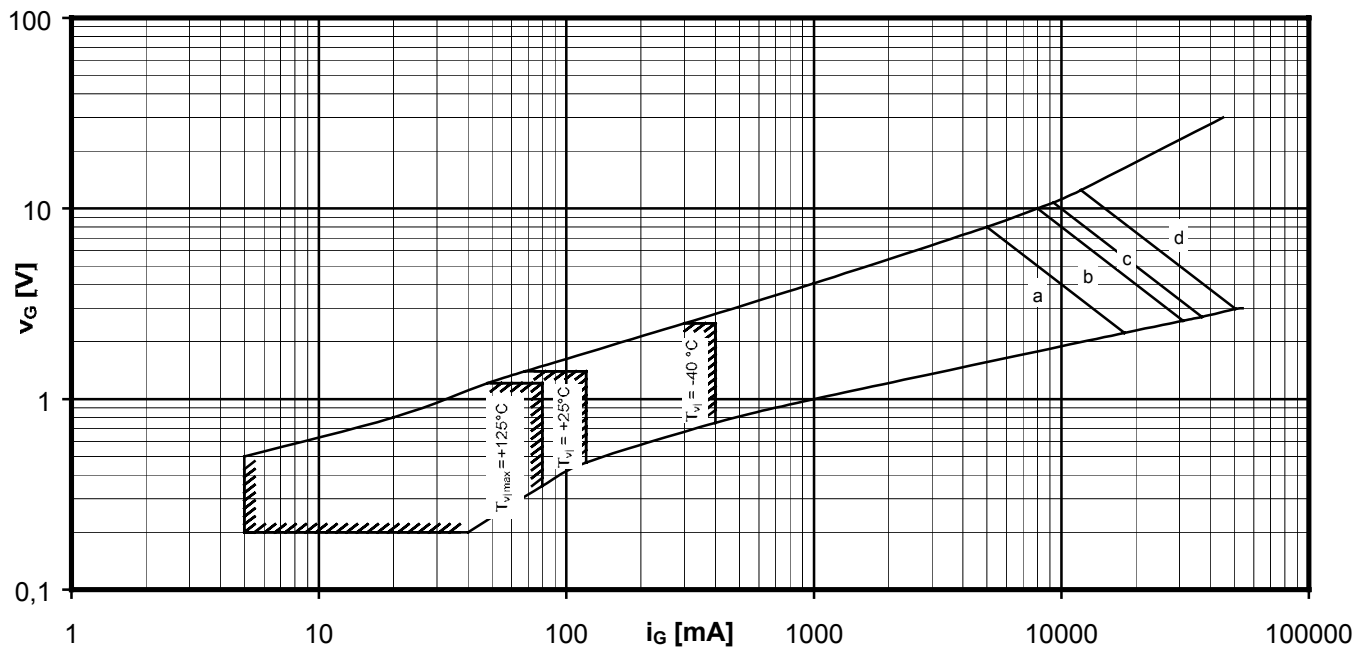
Parameter:

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



Netz-Thyristor-Modul
Phase Control Thyristor Module

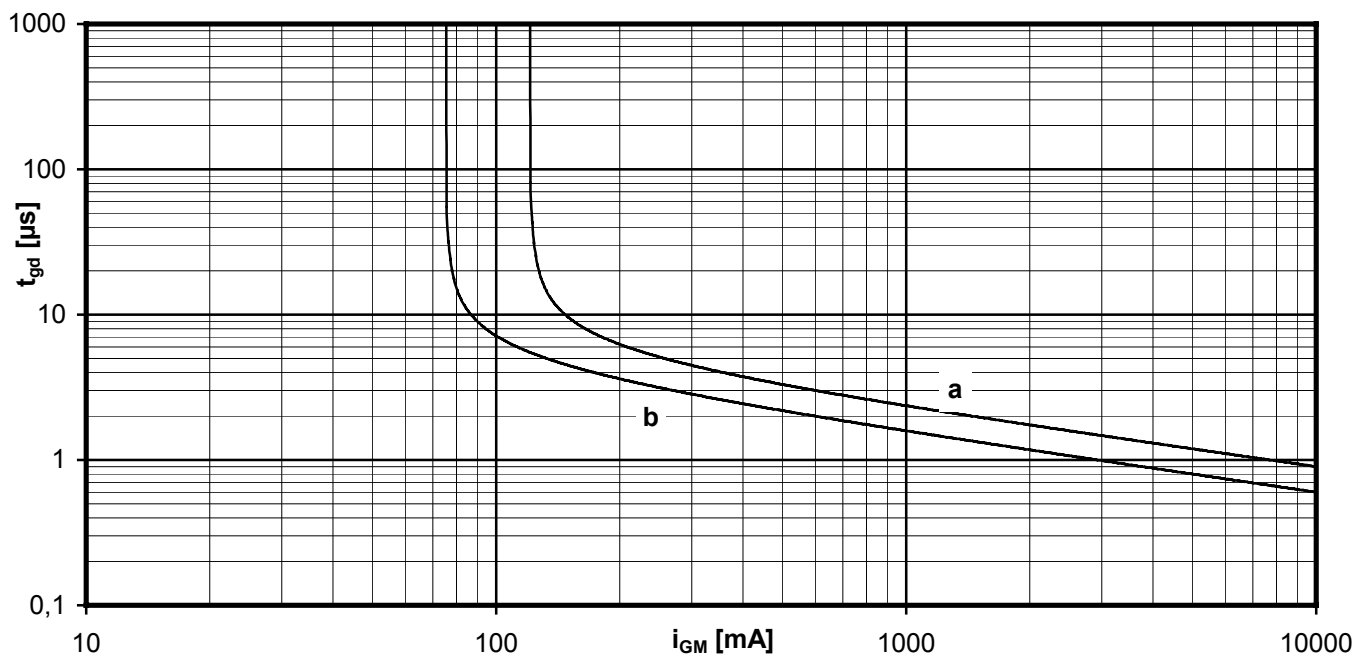
TT92N



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 - 150W/0,1ms

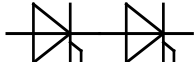


Zündverzögerung / Gate controlled delay time $t_{gd} = f(i_G)$

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

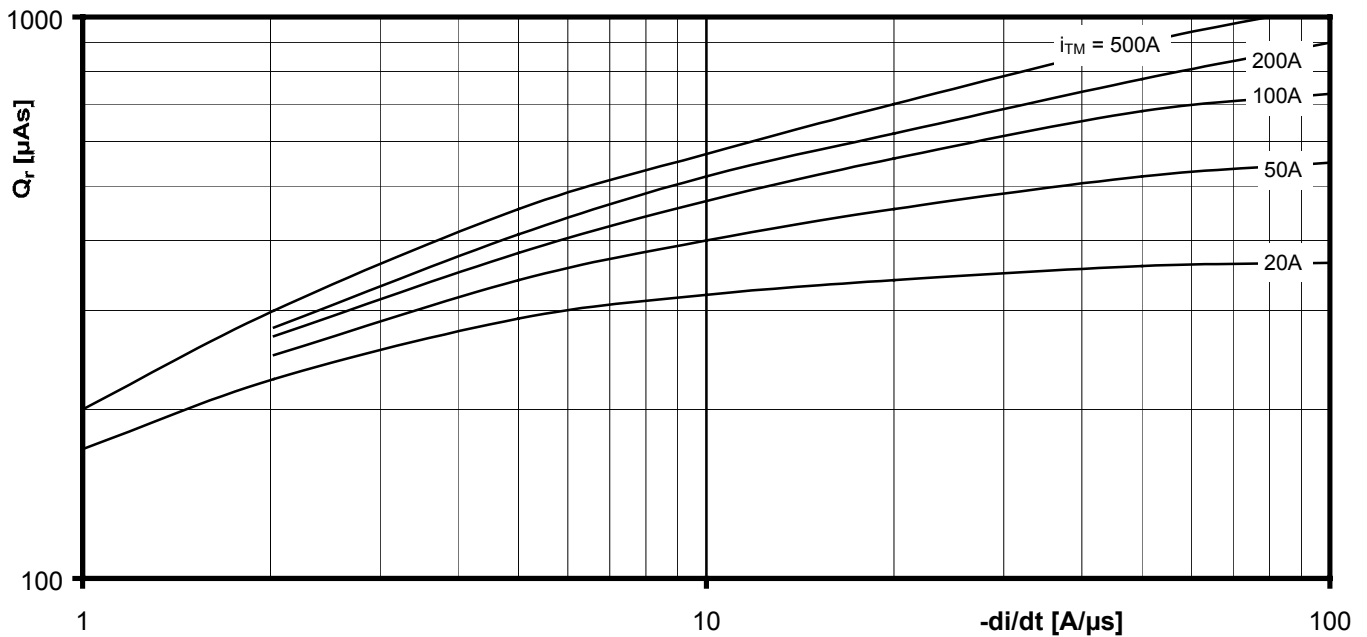
a - maximaler Verlauf / Limiting characteristic

b - typischer Verlauf / Typical characteristic



Netz-Thyristor-Modul
Phase Control Thyristor Module

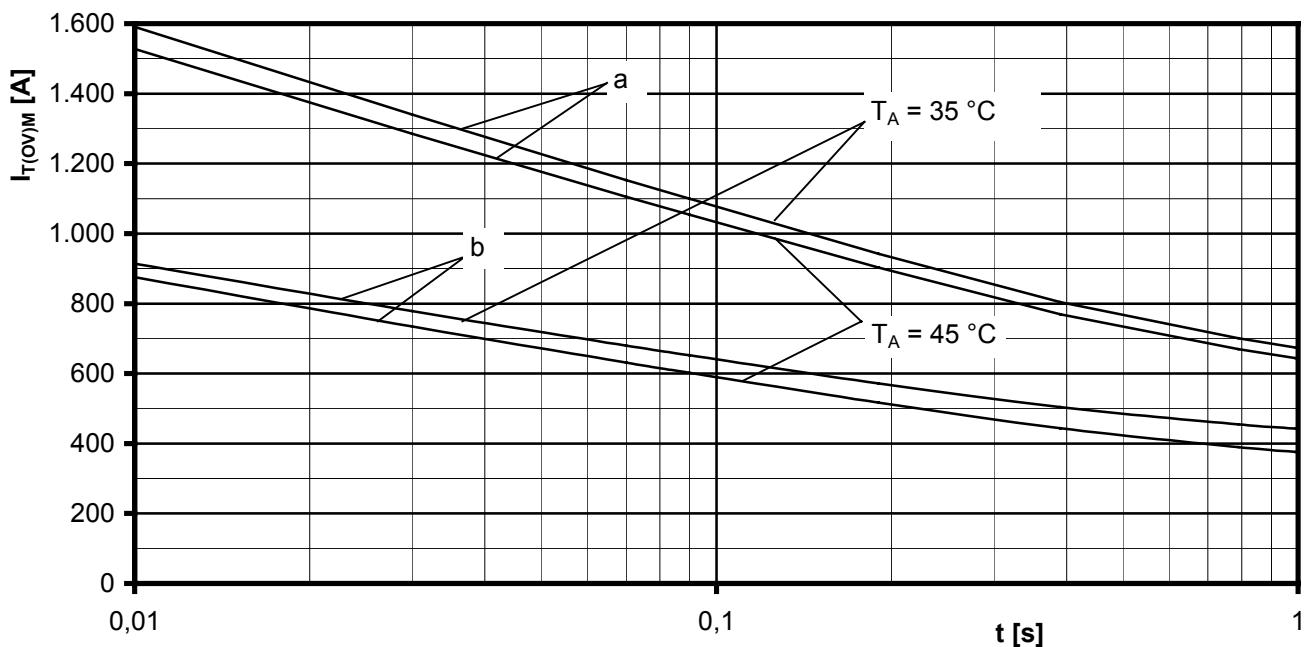
TT92N



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}



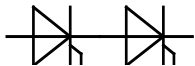
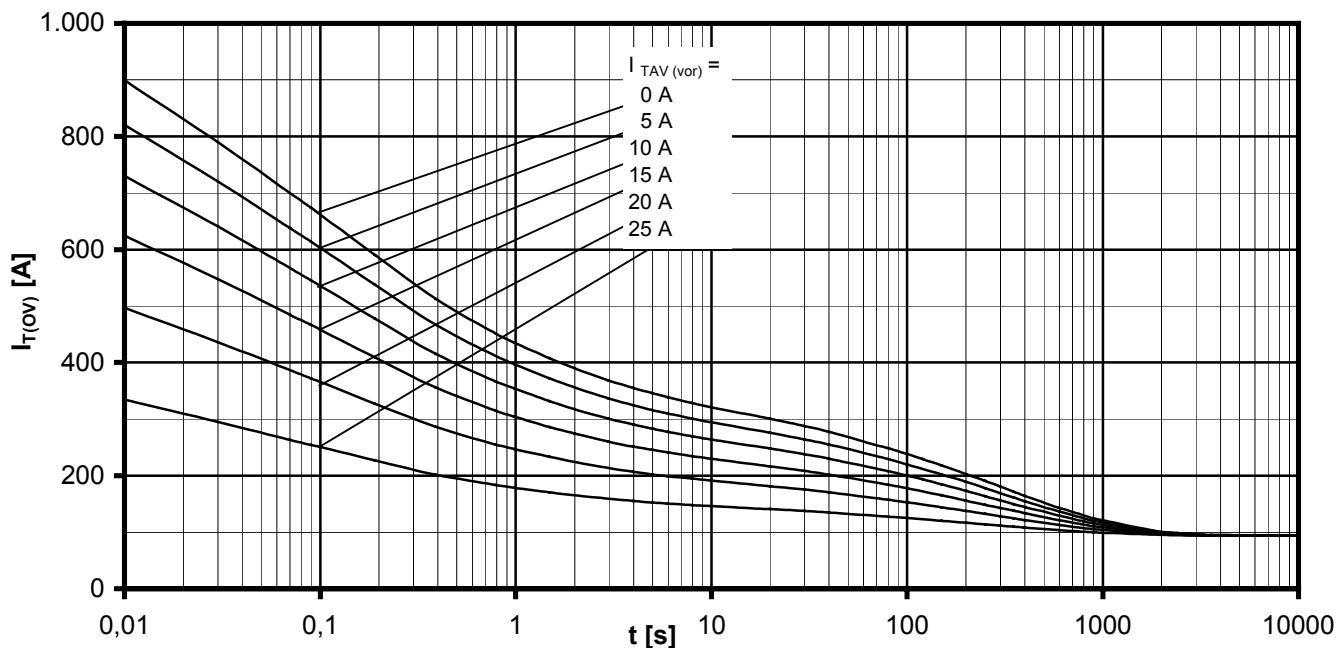
Grenzstrom / Maximum overload on-state current $I_{T(OV)M} = f(t), v_{RM} = 0,8 V_{RRM}$

a: Leerlauf / No-load conditions

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

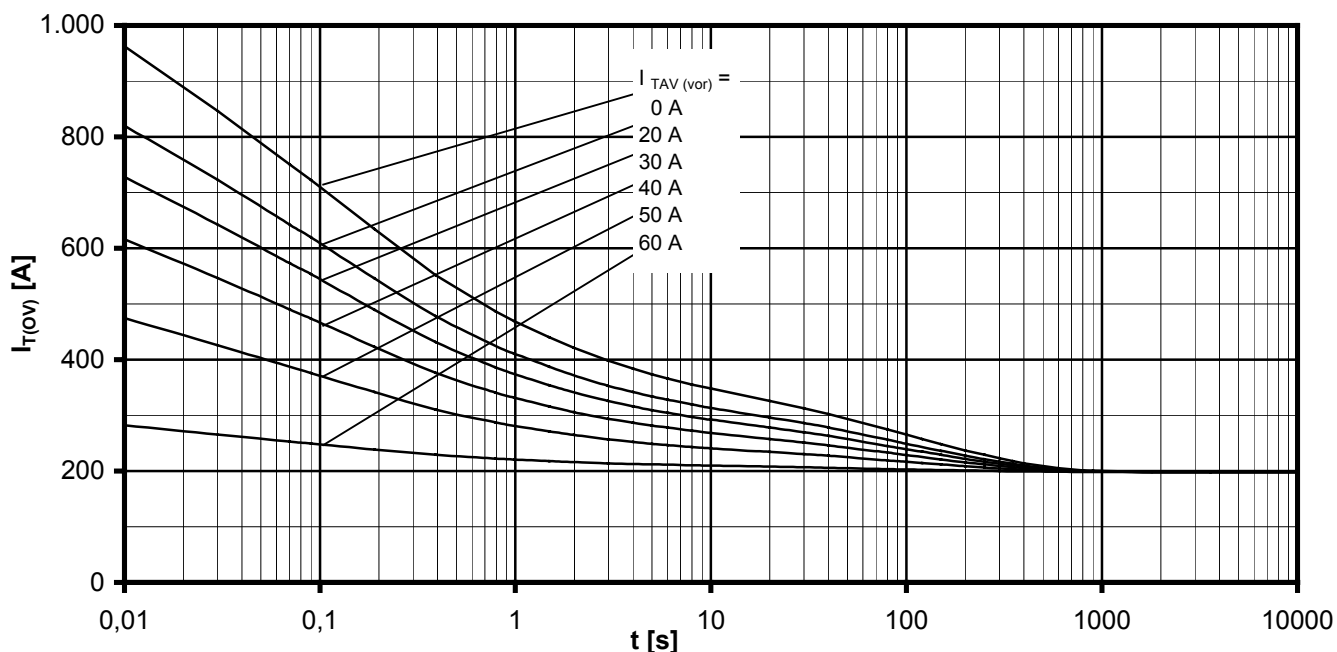
$T_A = 35^\circ\text{C}$, Luftselbstkühlung / Forced air cooling

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


Netz-Thyristor-Modul
Phase Control Thyristor Module
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Überstrom je Zweig / Overload on-state current $I_{T(ov)}$

B6- Sechspuls-Brückenschaltung, 120° Rechteck / Six-pulse bridge circuit, 120° rectangular

 Kühlkörper / Heatsink type KM14 (50W) 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° Rechteck / Six-pulse bridge circuit, 120° rectangular

 Kühlkörper / Heatsink type KM14 (Papst 4650N) verstärkte Kühlung bei / Forced cooling at $T_A = 35^\circ\text{C}$

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

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