


Netz-Thyristor-Modul
Phase Control Thyristor Module
TT330N

TT330N

TD330N

Elektrische Eigenschaften / Electrical properties

Höchstzulässige Werte / Maximum rated values

Periodische Vorwärts- und Rückwärts-Spitzenspannung 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-Stoßspitzenspannung 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-Stoßspitzenspannung 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}		520	A
Dauergrenzstrom average on-state current	$T_{\text{C}} = 85^{\circ}\text{C}$	I_{TAVM}		330	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}		9100 8000	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		414000 320000	A^2s A^2s
Kritische Stromsteilheit critical rate of rise of on-state current	DIN IEC 747-6 $f = 50\text{ Hz}, i_{\text{GM}} = 1\text{ A}, di_{\text{G}}/dt = 1\text{ A}/\mu\text{s}$	$(di_{\text{T}}/dt)_{\text{cr}}$		250	$\text{A}/\mu\text{s}$
Kritische Spannungssteilheit critical rate of rise of off-state voltage	$T_{vj} = T_{vj\text{ max}}, V_{\text{D}} = 0,67 V_{\text{DRM}}$ 6.Kennbuchstabe / 6 th letter C 6.Kennbuchstabe / 6 th letter F	$(dv_{\text{D}}/dt)_{\text{cr}}$		1000	$\text{V}/\mu\text{s}$

Charakteristische Werte / Characteristic values

Durchlaßspannung on-state voltage	$T_{vj} = T_{vj\text{ max}}, i_{\text{T}} = 800\text{ A}$	V_{T}	max.	1,44	V
Schleusenspannung threshold voltage	$T_{vj} = T_{vj\text{ max}}$	$V_{(\text{TO})}$		0,80	V
Ersatzwiderstand slope resistance	$T_{vj} = T_{vj\text{ max}}$	r_{T}		0,60	$\text{m}\Omega$
Zündstrom gate trigger current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6\text{ V}$	I_{GT}	max.	200	mA
Zündspannung gate trigger voltage	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6\text{ V}$	V_{GT}	max.	2	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.	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	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6\text{ V}, R_{\text{A}} = 5\ \Omega$	I_{H}	max.	300	mA
Einraststrom latching current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 6\text{ V}, R_{\text{GK}} \geq 10\ \Omega$ $i_{\text{GM}} = 1\text{ A}, di_{\text{G}}/dt = 1\text{ A}/\mu\text{s}, t_{\text{g}} = 20\ \mu\text{s}$	I_{L}	max.	1200	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.	70	mA
Zündverzug gate controlled delay time	DIN IEC 747-6 $T_{vj} = 25^{\circ}\text{C}, i_{\text{GM}} = 1\text{ A}, di_{\text{G}}/dt = 1\text{ A}/\mu\text{s}$	t_{gd}	max.	3	μs

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 Charakteristische Werte / Characteristic values

Freiwerdezeit circuit commutated turn-off time	$T_{vj} = T_{vj\max}$, $i_{TM} = I_{TAVM}$ $V_{RM} = 100\text{ V}$, $V_{DM} = 0,67 V_{DRM}$ $dv_D/dt = 20\text{ V}/\mu\text{s}$, $-di_T/dt = 10\text{ A}/\mu\text{s}$ 5.Kennbuchstabe / 5 th letter O	t_q	typ.	250	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}		3,0 3,6	kV kV

Thermische Eigenschaften / Thermal properties

Innerer Wärmewiderstand thermal resistance, junction to case	pro Modul / per Module, $\Theta = 180^\circ\text{ sin}$ pro Zweig / per arm, $\Theta = 180^\circ\text{ sin}$ pro Modul / per Module, DC pro Zweig / per arm, DC	R_{thJC}	max.	0,059	$^\circ\text{C}/\text{W}$
			max.	0,117	$^\circ\text{C}/\text{W}$
			max.	0,056	$^\circ\text{C}/\text{W}$
			max.	0,111	$^\circ\text{C}/\text{W}$
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per Module pro Zweig / per arm	R_{thCH}	max.	0,02	$^\circ\text{C}/\text{W}$
			max.	0,04	$^\circ\text{C}/\text{W}$
Höchstzulässige Sperrschichttemperatur maximum junction temperature		$T_{vj\max}$		135	$^\circ\text{C}$
Betriebstemperatur operating temperature		$T_{c\text{ op}}$		-40...+135	$^\circ\text{C}$
Lagertemperatur storage temperature		T_{stg}		-40...+135	$^\circ\text{C}$

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		5	Nm
Anzugsdrehmoment für elektrische Anschlüsse terminal connection torque	Toleranz / Tolerance $\pm 10\%$	M2		12	Nm
Steueranschlüsse control terminals	DIN 46 244			A 2,8 x 0,8	
Gewicht weight		G	typ.	800	g
Kriechstrecke creepage distance				17	mm
Schwingfestigkeit vibration resistance	$f = 50\text{ Hz}$			50	m/s^2
	file-No.			E 83336	

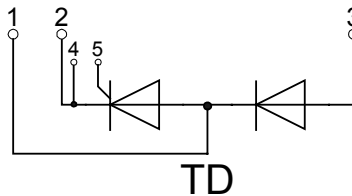
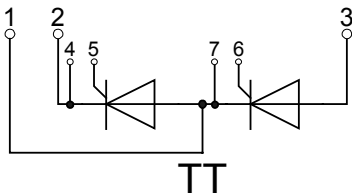
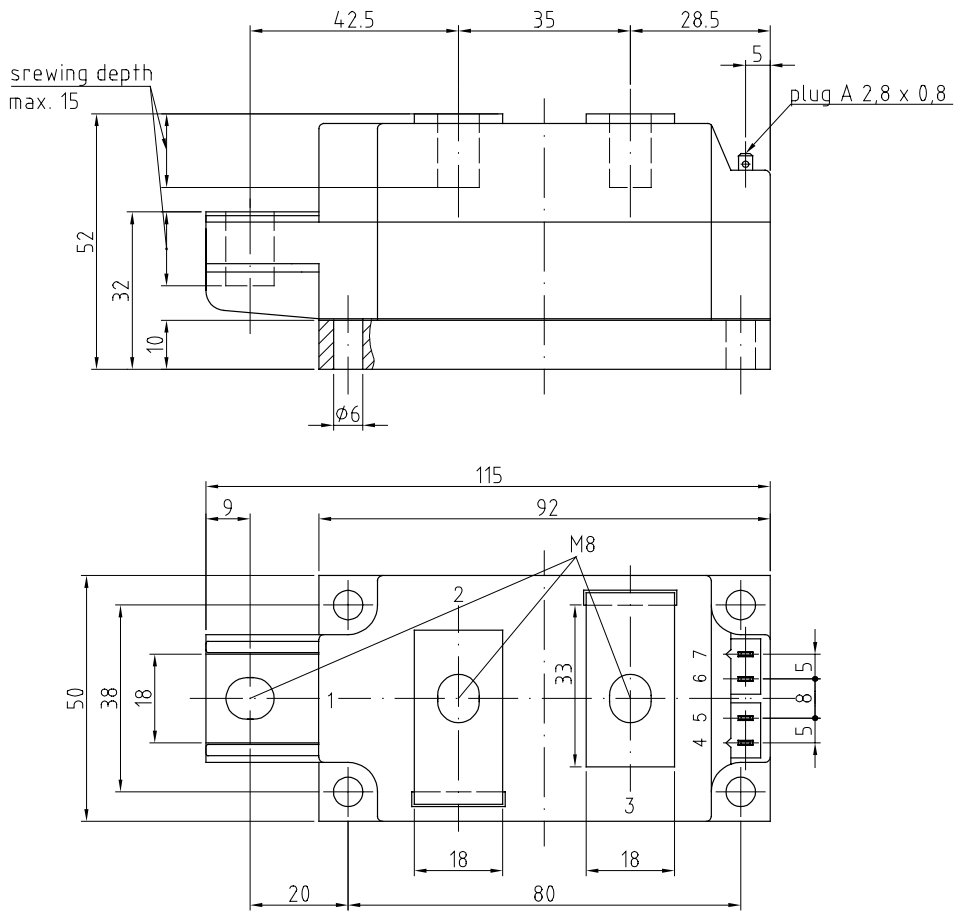
Mit diesem Datenblatt werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert. Es gilt in Verbindung mit den zugehörigen technischen Erläuterungen.

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



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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]	0,0031	0,0097	0,0259	0,0359	0,0366		
τ_n [s]	0,0009	0,008	0,11	0,61	3,06		

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 (45W)

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

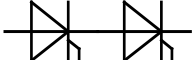
Pos. n	1	2	3	4	5	6	7
R_{thn} [°C/W]	1,6	0,0726	0,0174				
τ_n [s]	1400	30	2				

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}

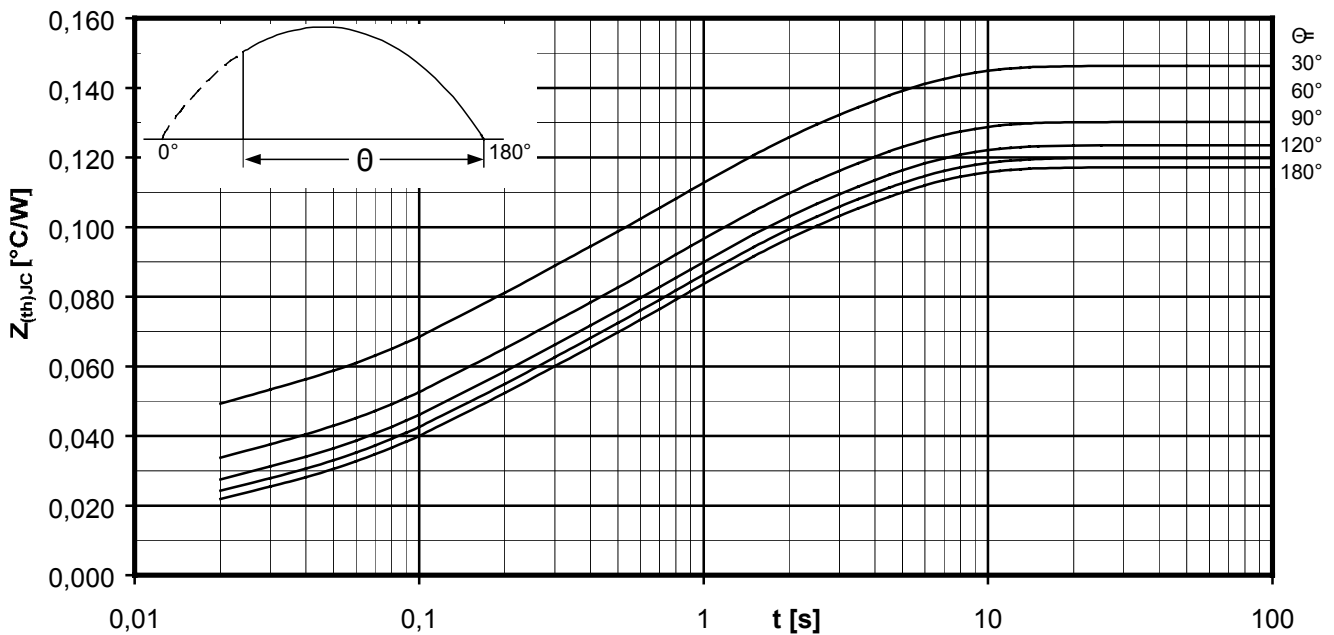
Pos. n	1	2	3	4	5	6	7
R_{thn} [°C/W]	0,475	0,08	0,015				
τ_n [s]	458	40,4	4,11				

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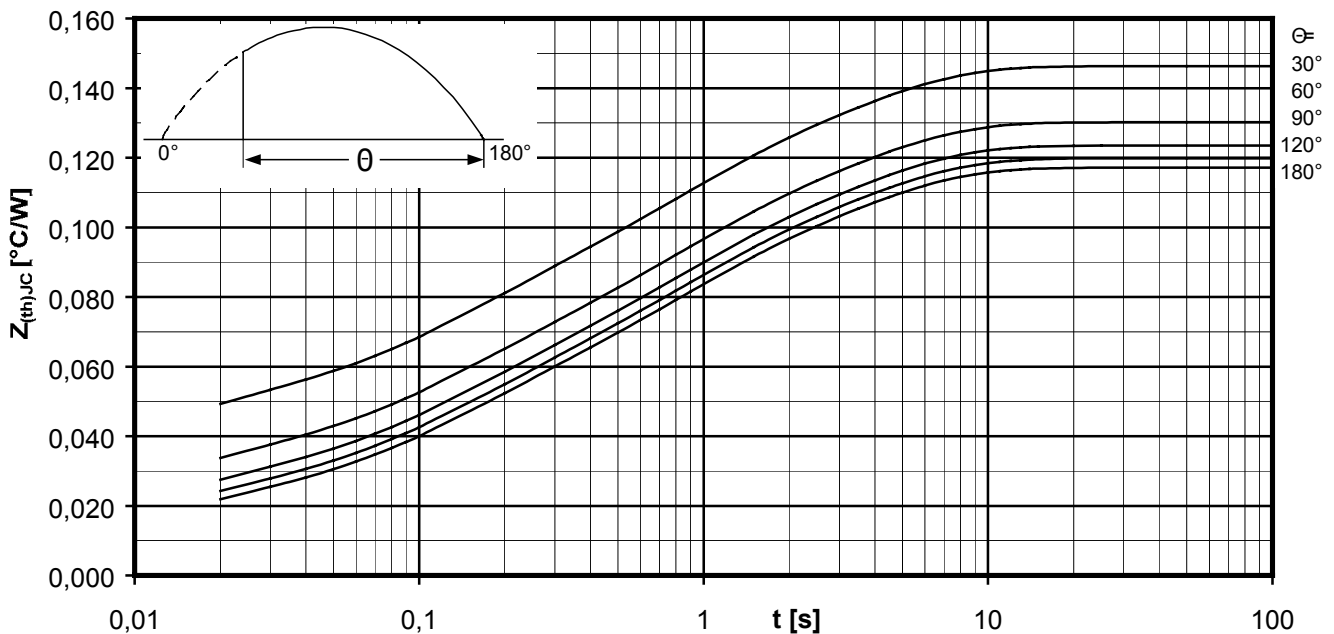
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Transienter innerer Wärmewiderstand je Zweig / Transient thermal impedance per arm $Z_{thJC} = f(t)$

Sinusförmiger Strom / Sinusoidal current

Parameter: Stromflußwinkel Θ / Current conduction angle Θ



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

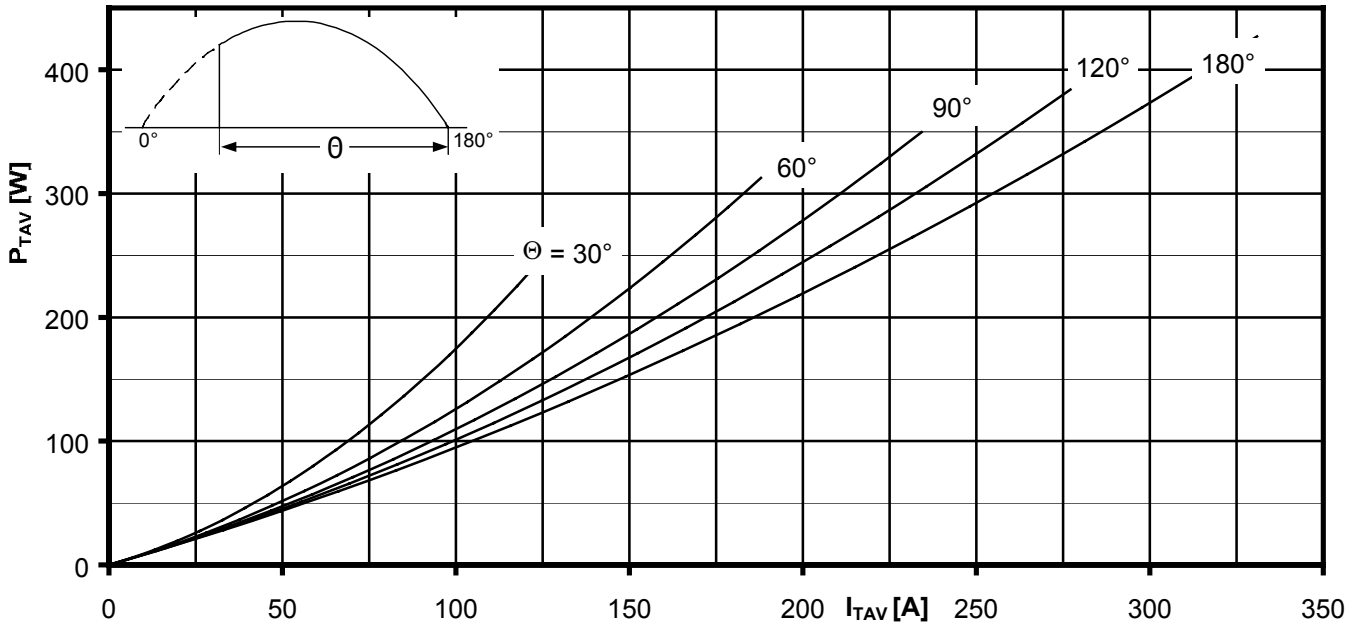
Rechteckförmiger Strom / Rectangular current

Parameter: Stromflußwinkel Θ / Current conduction angle Θ



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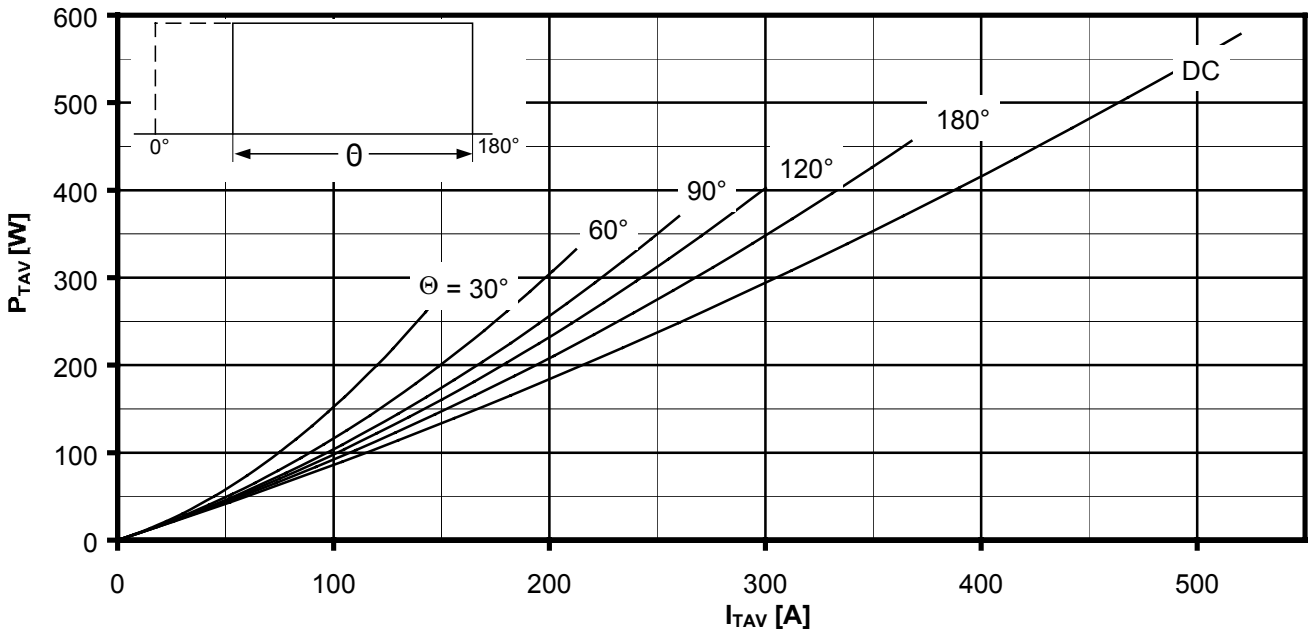


Durchlassverlustleistung je Zweig / On-state power loss per arm $P_{TAV} = f(I_{TAV})$

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

Berechnungsgrundlage P_{TAV} (Schaltverluste gesondert berücksichtigen)
Calculation base P_{TAV} (switching losses should be considered separately)

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

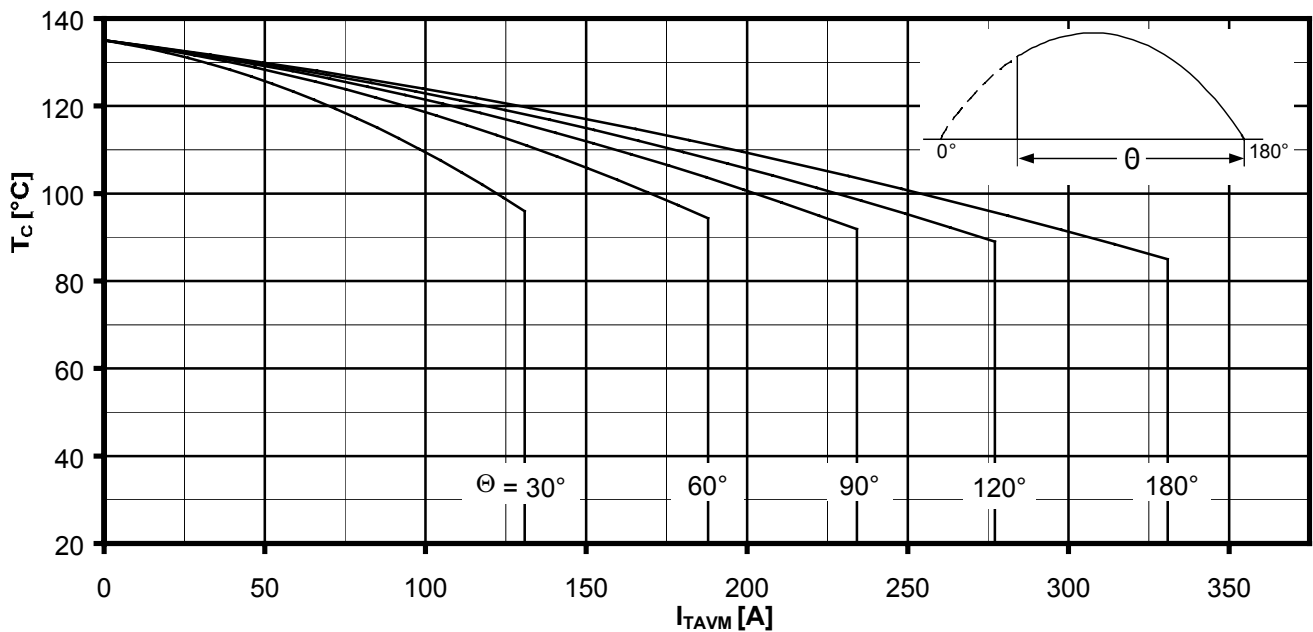
Berechnungsgrundlage P_{TAV} (Schaltverluste gesondert berücksichtigen)
Calculation base P_{TAV} (switching losses should be considered separately)

Parameter: Stromflußwinkel / Current conduction angle Θ



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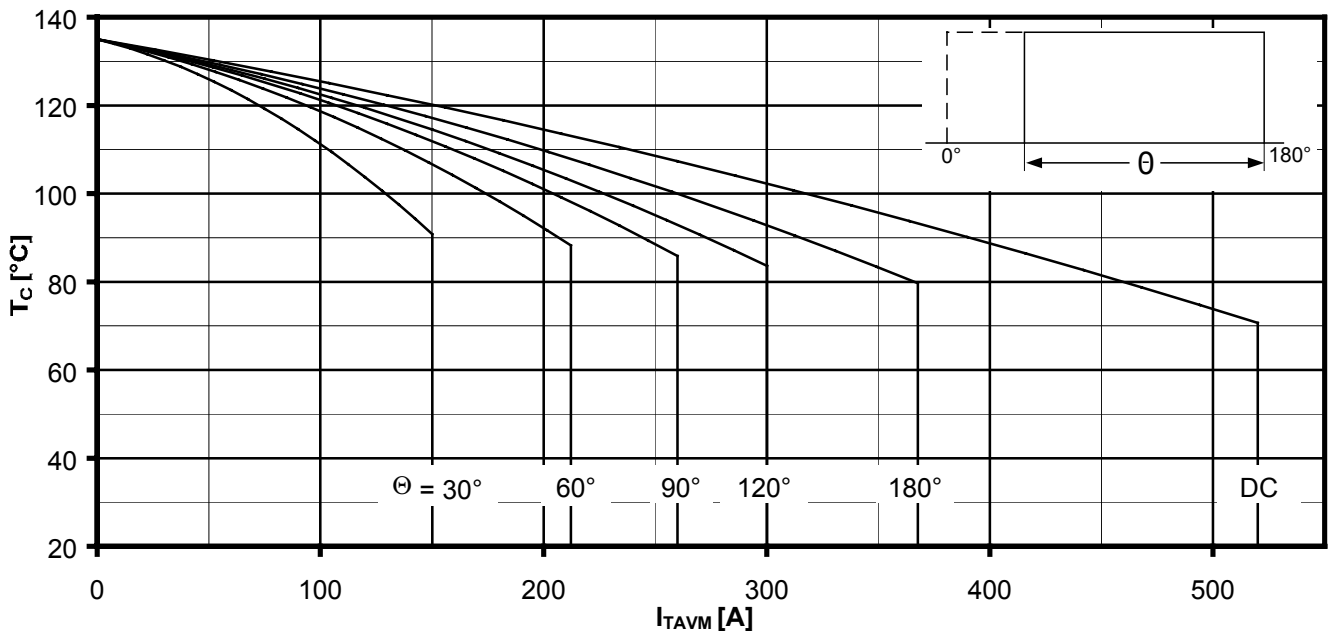


Höchstzulässige Gehäusetemperatur / Maximum allowable case temperature $T_c = f(I_{TAVM})$

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

Berechnungsgrundlage P_{TAV} (Schaltverluste gesondert berücksichtigen)
Calculation base P_{TAV} (switching losses should be considered separately)

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

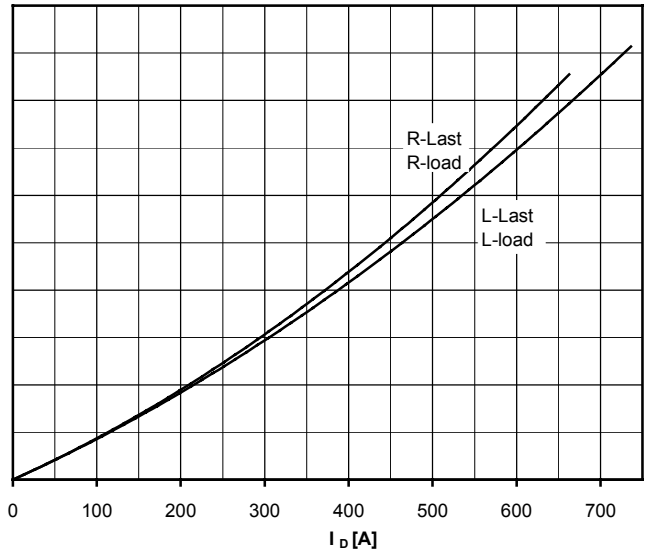
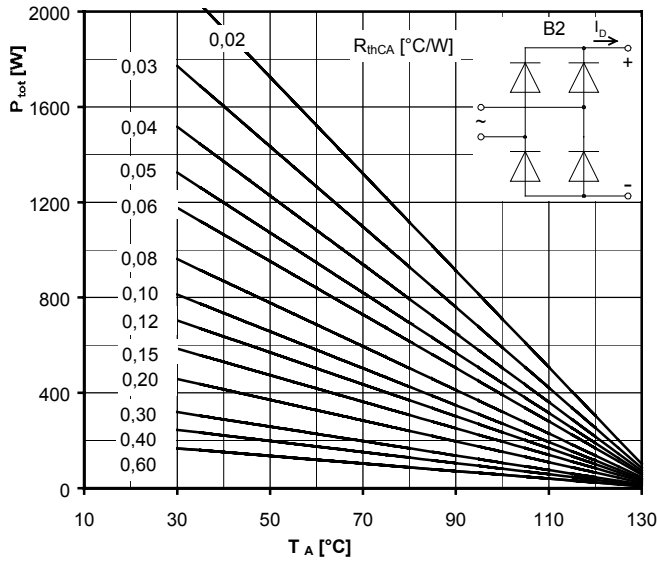
Berechnungsgrundlage P_{TAV} (Schaltverluste gesondert berücksichtigen)
Calculation base P_{TAV} (switching losses should be considered separately)

Parameter: Stromflußwinkel Θ / Current conduction angle Θ



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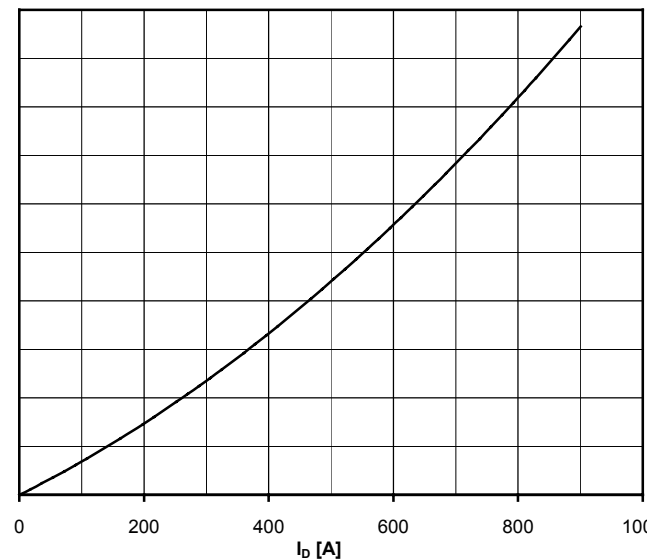
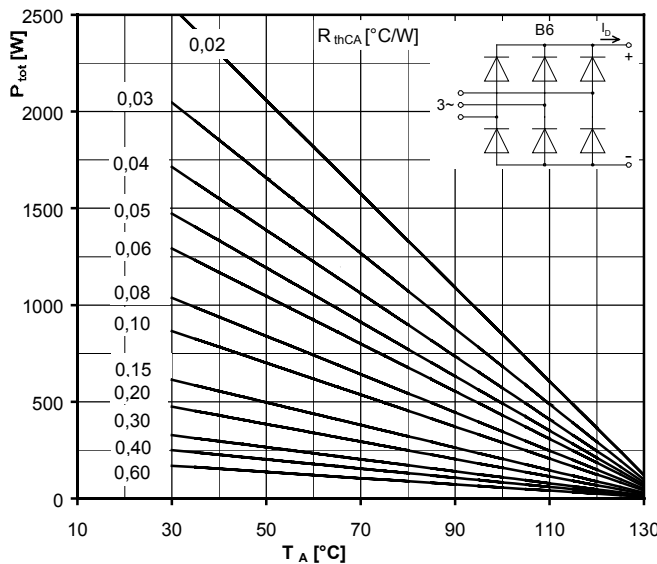
Höchstzulässiger Ausgangsstrom / Maximum rated output current I_D

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}

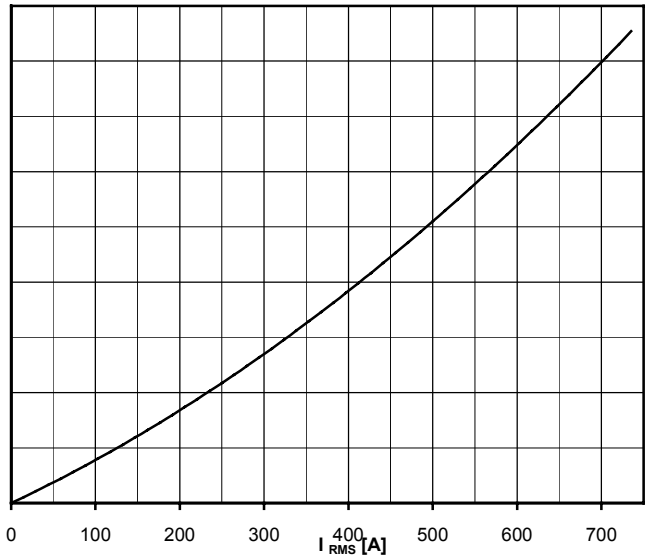
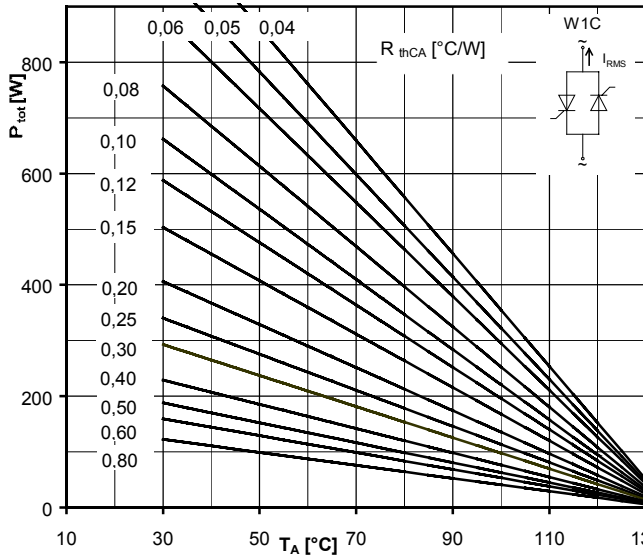
Parameter:

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



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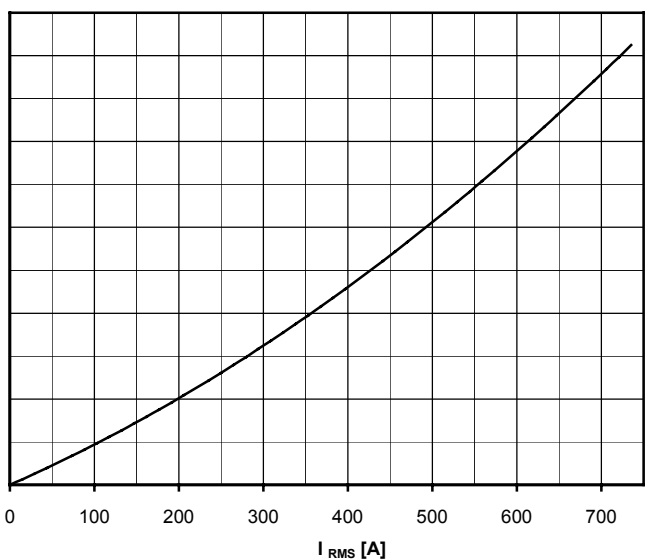
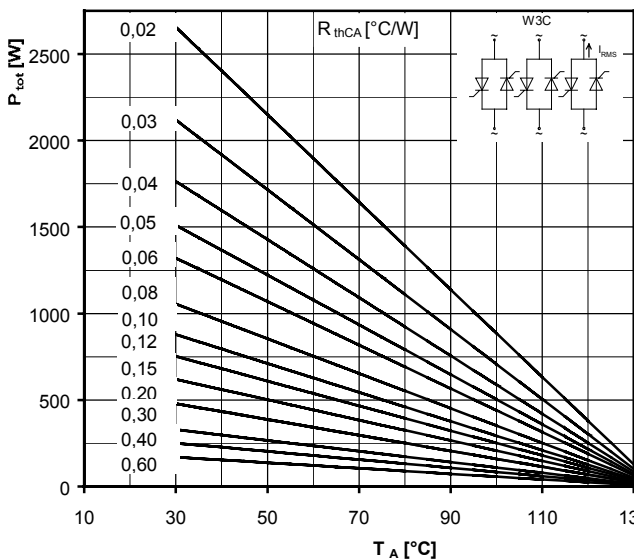
Höchstzulässiger Effektivstrom / Maximum rated RMS current I_{RMS}

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}

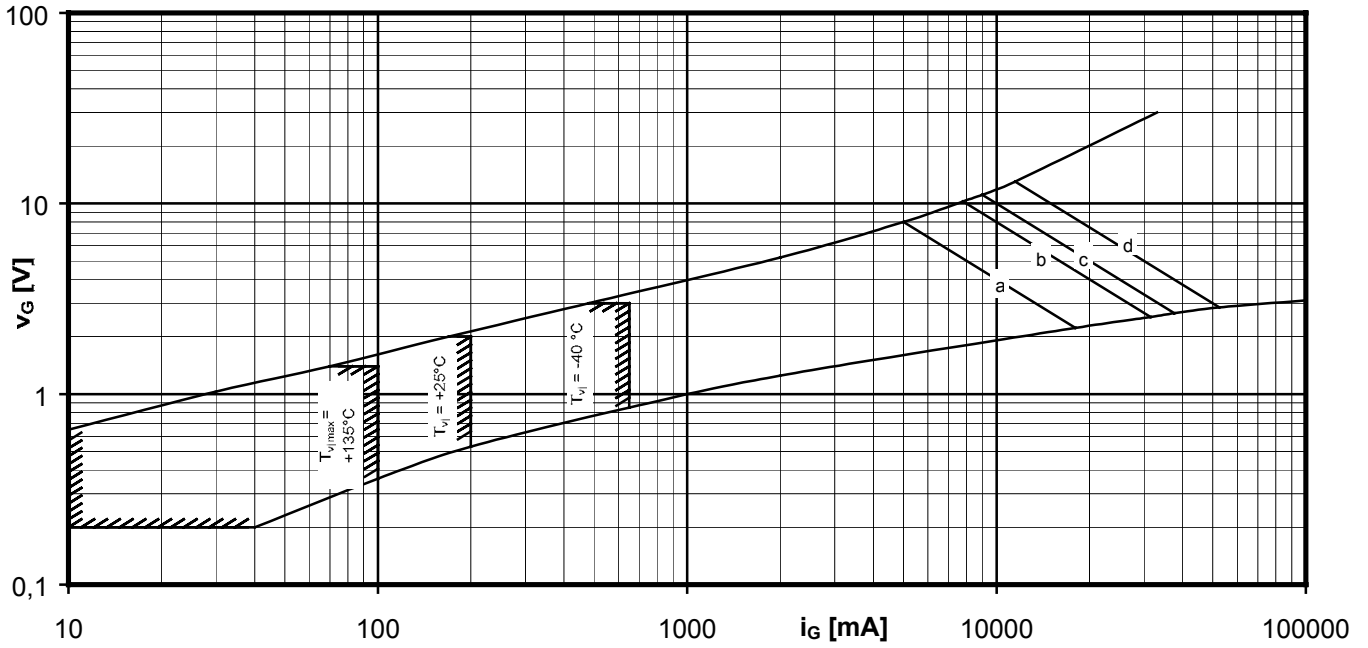
Parameter:

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



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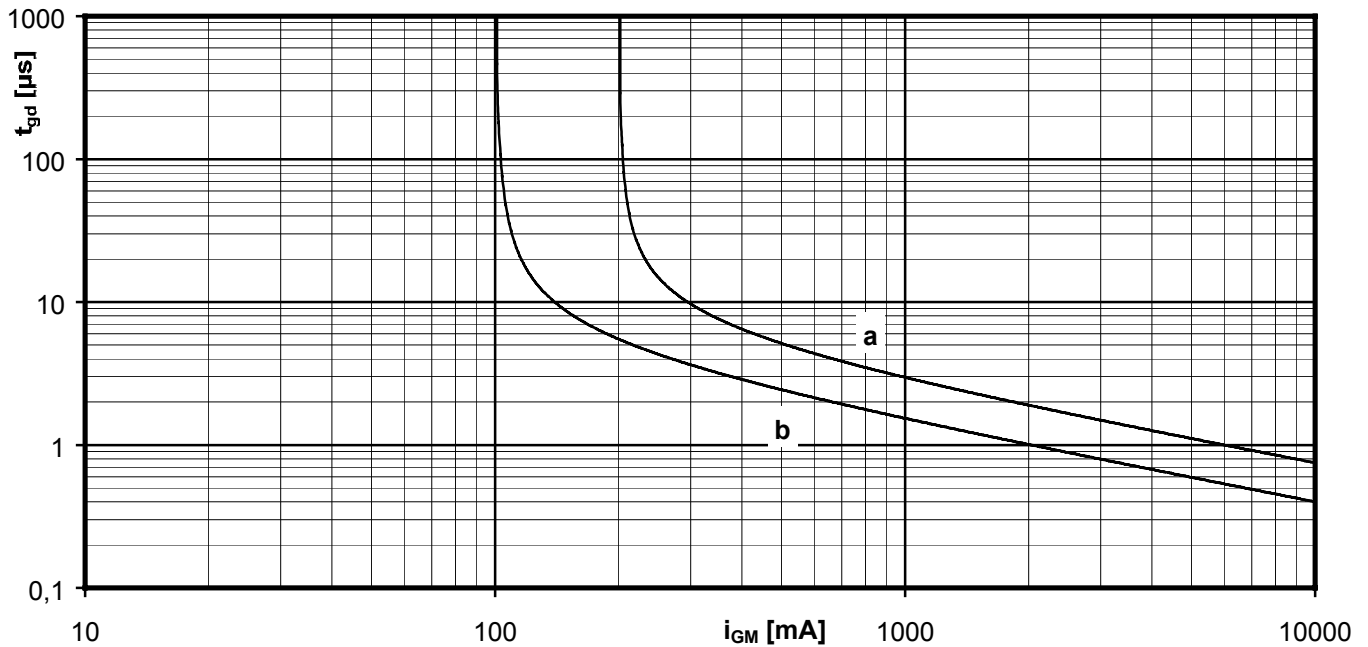
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Steuercharakteristik $v_G = f(i_G)$ mit Zündbereichen für $V_D = 6\text{ V}$
Gate characteristic $v_G = f(i_G)$ with triggering area for $V_D = 6\text{ V}$

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 - 150W/0,1s



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

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

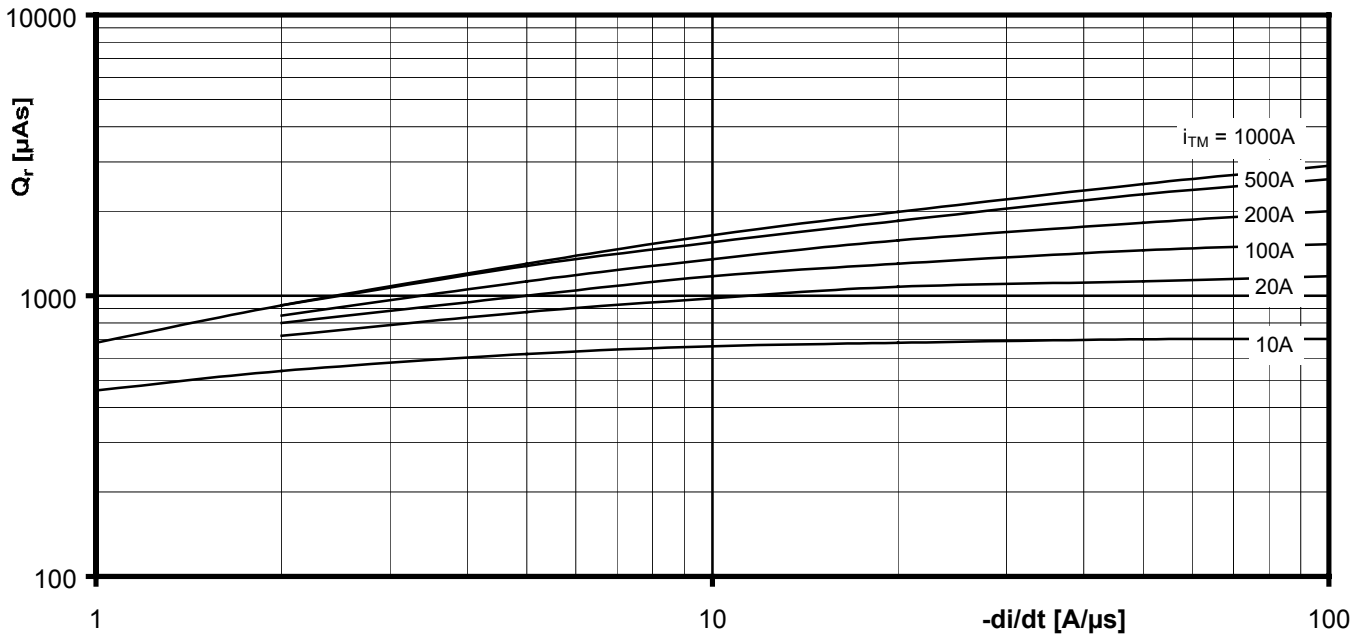
a - maximaler Verlauf / Limiting characteristic

b - typischer Verlauf / Typical characteristic



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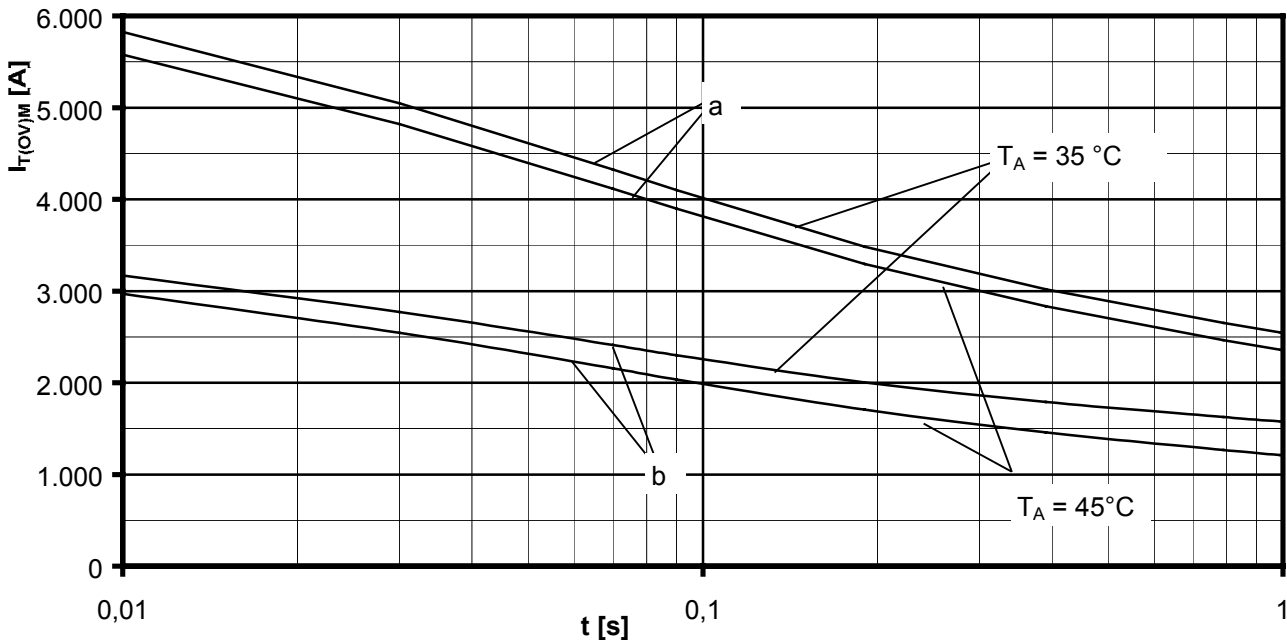
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Sperrverzögerungsladung / Recovered charge $Q_r = f(-di/dt)$

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

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



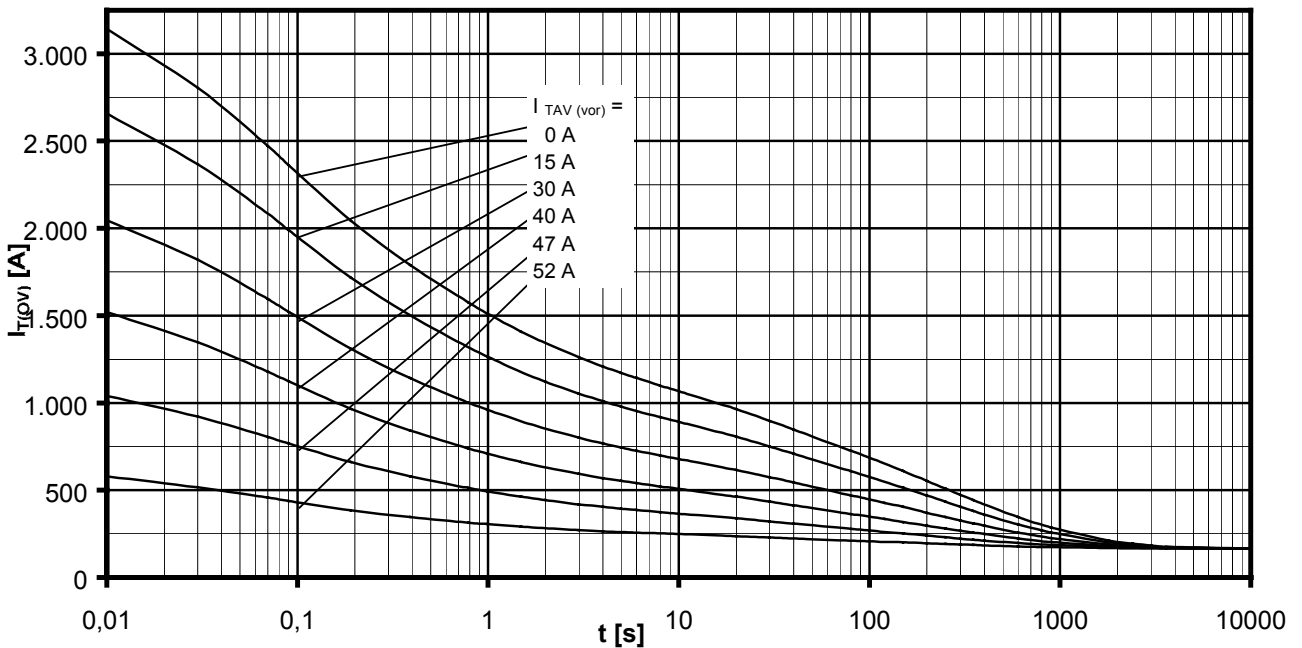
Grenzstrom / Maximum overload on-state current $I_{T(OV)M} = f(t), v_{RM} = 0,8 V_{RRM}$

- 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



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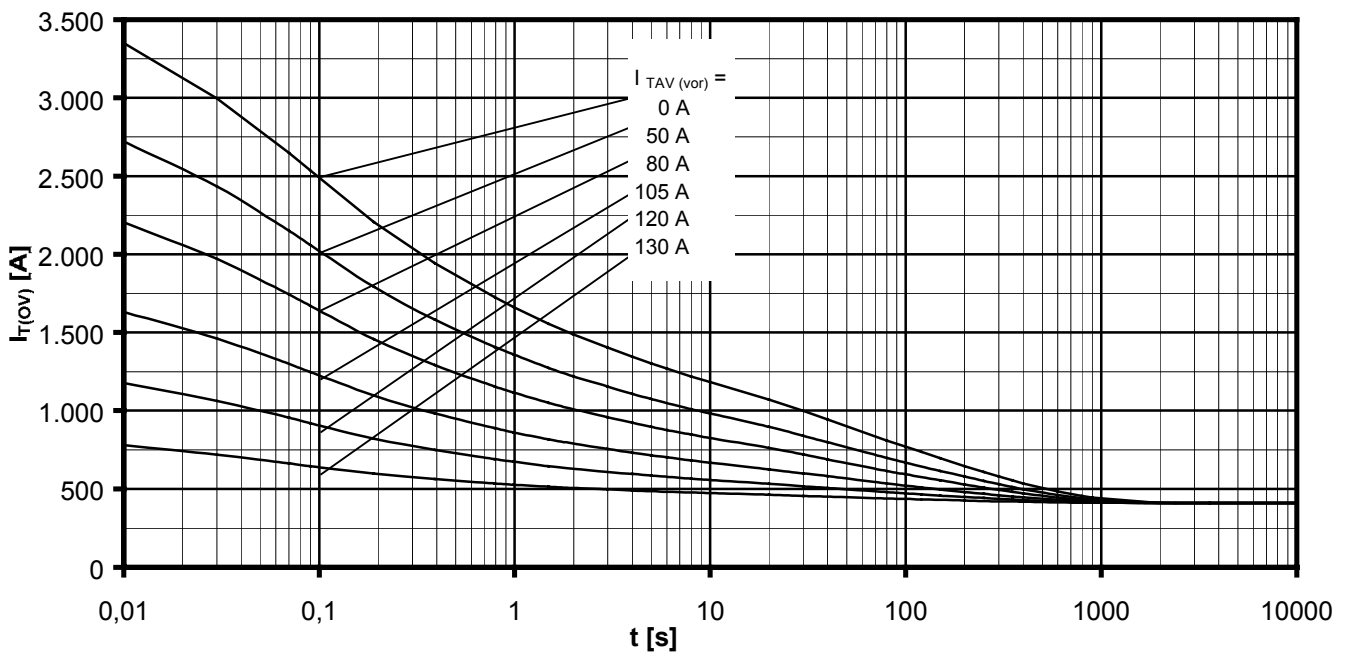


Überstrom je Zweig / Overload on-state current $I_{T(OV)}$

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

Kühlkörper / Heatsink type KM17 (45W) 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 KM17 (Papst 4650N) Verstärkte Kühlung bei / Forced cooling at $T_A = 35^\circ\text{C}$

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

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