

**Technische Information /  
technical information**



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

**TT160N16SOF**

Infineon Technologies Bipolar  
GmbH & Co. KG

**Key Parameters**

$V_{DRM} / V_{RRM}$	1600 V
$I_{TAVM}$	160 A ( $T_C=85\text{ °C}$ )
$I_{TSM}$	5200 A
$V_{T0}$	1,1 V
$r_T$	0,99 m $\Omega$
$R_{thJC}$	0,145 K/W
Base plate	34 mm
Weight	165 g



For type designation please refer to actual short form catalog

<http://www.ifbip.com/catalog>

**Merkmale**

- Löt-Bond Technologie
- Industrie-Standard-Gehäuse
- Elektrisch isolierte Bodenplatte

**Features**


- Solder-Bond Technology
- Industrial standard package
- Electrically insulated base plate

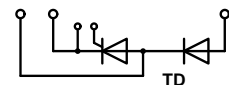
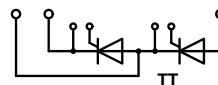
**Typische Anwendungen**

- Sanftanlasser
- Gleichrichter für Antriebsapplikationen
- Leistungssteller
- Gleichrichter für UPS
- Batterieladegleichrichter
- Statische Umschalter

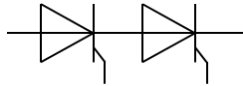
**Typical Applications**

- Soft starter
- Rectifier for drives applications
- Power controllers
- Rectifiers for UPS
- Battery chargers
- Static switches

		
content of customer DMX code	DMX code digit	DMX code digit quantity
type designation	1..18	18
serial number	19..23	5
internal production order number	24..31	8
material number	32..41	10
date code (YY/WW)	42..45	4
add on for date code	46	1



[www.ifbip.com](http://www.ifbip.com)  
[support@infineon-bip.com](mailto:support@infineon-bip.com)



## Technische Information / technical information



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

# TT160N16SOF

Infineon Technologies Bipolar  
GmbH & Co. KG

TT160N16SOF

TD160N16SOF

### Elektrische Eigenschaften / Electrical properties

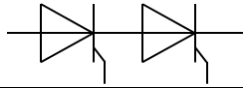
Höchstzulässige Werte / Maximum rated values

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	V
Vorwärts-Stoßspitzensperrspannung non-repetitive peak forward off-state voltage	$T_{vj} = -40^{\circ}\text{C} \dots T_{vj\text{max}}$	$V_{\text{DSM}}$	1600	V
Rückwärts-Stoßspitzensperrspannung non-repetitive peak reverse voltage	$T_{vj} = +25^{\circ}\text{C} \dots T_{vj\text{max}}$	$V_{\text{RSM}}$	1700	V
Durchlaßstrom-Grenzeffektivwert maximum RMS on-state current		$I_{\text{TRMSM}}$	275	A
Dauergrenzstrom average on-state current	$T_C = 85^{\circ}\text{C}$	$I_{\text{TAVM}}$	160	A
Stoßstrom-Grenzwert surge current	$T_{vj} = 25^{\circ}\text{C}, t_P = 10\text{ms}$ $T_{vj} = T_{vj\text{max}}, t_P = 10\text{ms}$	$I_{\text{TSM}}$	5200 4500	A A
Grenzlastintegral $I^2t$ -value	$T_{vj} = 25^{\circ}\text{C}, t_P = 10\text{ms}$ $T_{vj} = T_{vj\text{max}}, t_P = 10\text{ms}$	$I^2t$	135200 101250	$\text{A}^2\text{s}$ $\text{A}^2\text{s}$
Kritische Stromsteilheit critical rate of rise of on-state current	DIN IEC 747-6 $f = 50\text{Hz}, i_{\text{GM}} = 1\text{A}, di_{\text{G}}/dt = 1\text{A}/\mu\text{s}$	$(di_{\text{T}}/dt)_{\text{cr}}$	100	$\text{A}/\mu\text{s}$
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 <sup>th</sup> letter F	$(dv_{\text{D}}/dt)_{\text{cr}}$	1000	$\text{V}/\mu\text{s}$

### Charakteristische Werte / Characteristic values

Durchlaßspannung on-state voltage	$T_{vj} = T_{vj\text{max}}, I_{\text{T}} = 500\text{A}$	$V_{\text{T}}$	max. 1,82	V
Schleusenspannung threshold voltage	$T_{vj} = T_{vj\text{max}}$	$V_{(\text{TO})}$	max. 1,1	V
Ersatzwiderstand slope resistance	$T_{vj} = T_{vj\text{max}}$	$r_{\text{T}}$	max. 0,99	$\text{m}\Omega$
Zündstrom gate trigger current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}$	$I_{\text{GT}}$	max. 145	$\text{mA}$
Zündspannung gate trigger voltage	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}$	$V_{\text{GT}}$	max. 2,5	V
Nicht zündender Steuerstrom gate non-trigger current	$T_{vj} = T_{vj\text{max}}, V_{\text{D}} = 12\text{V}$ $T_{vj} = T_{vj\text{max}}, V_{\text{D}} = 0,5 V_{\text{DRM}}$	$I_{\text{GD}}$	max. 10 max. 5	$\text{mA}$ $\text{mA}$
Nicht zündende Steuerspannung gate non-trigger voltage	$T_{vj} = T_{vj\text{max}}, V_{\text{D}} = 0,5 V_{\text{DRM}}$	$V_{\text{GD}}$	max. 0,25	V
Haltestrom holding current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}, R_{\text{A}} = 1\Omega$	$I_{\text{H}}$	max. 200	$\text{mA}$
Einraststrom latching current	$T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}, R_{\text{GK}} \geq 10\Omega$ $i_{\text{GM}} = 1\text{A}, di_{\text{G}}/dt = 1\text{A}/\mu\text{s}, t_{\text{g}} = 20\mu\text{s}$	$I_{\text{L}}$	max. 400	$\text{mA}$
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. 30	$\text{mA}$
Zündverzug gate controlled delay time	DIN IEC 747-6 $T_{vj} = 25^{\circ}\text{C}, i_{\text{GM}} = 1\text{A}, di_{\text{G}}/dt = 1\text{A}/\mu\text{s}$	$t_{\text{gd}}$	max. 2	$\mu\text{s}$

prepared by: AG	Date of publication: 2017-06-14
approved by: MS	Revision: 3.2



## Technische Information / technical information



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

# TT160N16SOF

Infineon Technologies Bipolar  
GmbH & Co. KG

### Elektrische Eigenschaften / Electrical properties


Charakteristische Werte / Characteristic values

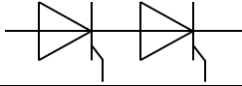
Freiwerdezeit circuit commutated turn-off time	$T_{vj} = T_{vj\max}$ , $i_{TM} = I_{TAVM}$ $V_{RM} = 100\text{ V}$ , $v_{DM} = 0,67 V_{DRM}$ $dv_D/dt = 20\text{ V}/\mu\text{s}$ , $-di_T/dt = 10\text{ A}/\mu\text{s}$ 5.Kennbuchstabe / 5 <sup>th</sup> letter O	$t_q$	typ.	320	$\mu\text{s}$
Isolations-Prüfspannung 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.	0,0825	K/W
			max.	0,165	K/W
			max.	0,0725	K/W
			max.	0,145	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per Module pro Zweig / per arm	$R_{thCH}$	max.	0,04	K/W
			max.	0,08	K/W
Höchstzulässige Sperrschichttemperatur maximum junction temperature		$T_{vj\max}$		125	$^\circ\text{C}$
Betriebstemperatur operating temperature		$T_{c\text{ op}}$		-40...+125	$^\circ\text{C}$
Lagertemperatur storage temperature		$T_{stg}$		-40...+125	$^\circ\text{C}$

### Mechanische Eigenschaften / Mechanical properties

Gehäuse, siehe Anlage case, see annex				Seite 4 page 4	
Innere Isolation internal insulation	Basisisolation (Schutzklasse 1, EN61140) Basic insulation (class 1, IEC61140)			$\text{Al}_2\text{O}_3$	
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		5	Nm
Steueranschlüsse control terminals	DIN 46 244			A 2,8 x 0,8	
Gewicht weight		G	typ.	165	g
Kriechstrecke creepage distance				10	mm
Schwingfestigkeit vibration resistance	$f = 50\text{ Hz}$			50	$\text{m/s}^2$
	file-No.			E 83335	



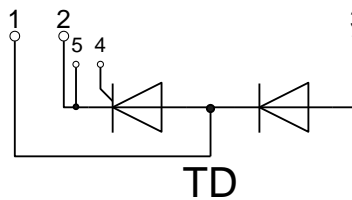
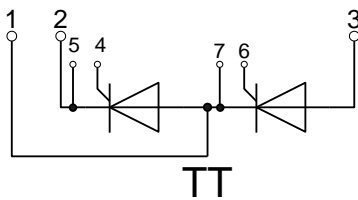
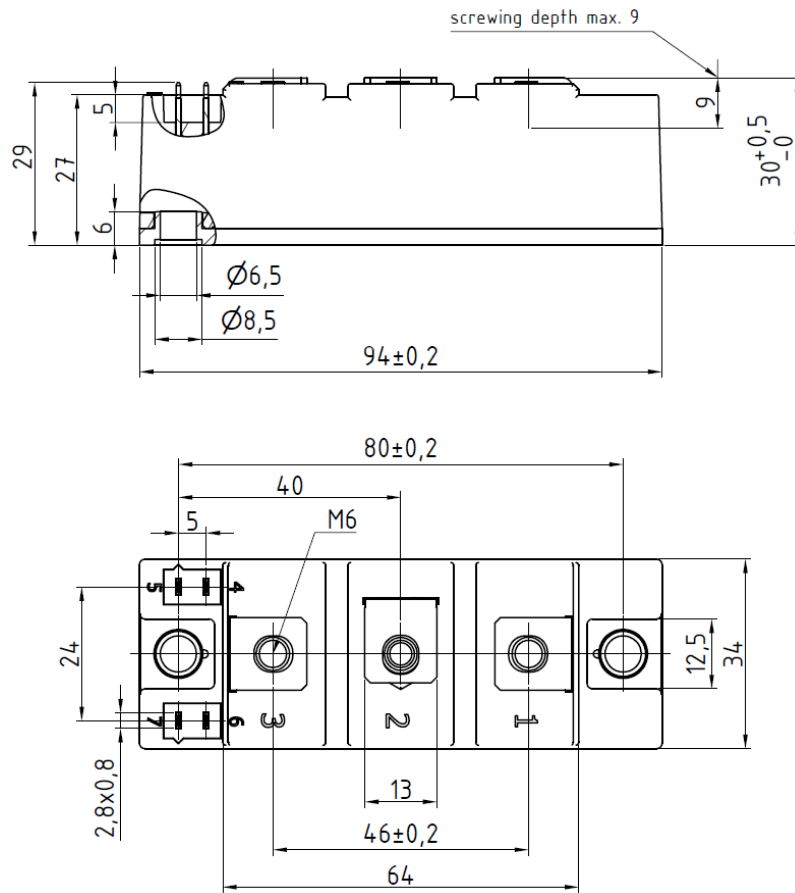
Technische Information /  
technical information

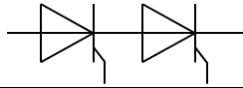


Netz-Thyristor-Modul  
Phase Control Thyristor Module

**TT160N16SOF**

Infineon Technologies Bipolar  
GmbH & Co. KG





Technische Information /  
technical information



Netz-Thyristor-Modul  
Phase Control Thyristor Module

**TT160N16SOF**

Infineon Technologies Bipolar  
GmbH & Co. KG

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
$R_{thn}$ [K/W]	0,0669	0,0024648	0,0674976	0,0076896			
$\tau_n$ [s]	0,035107	0,035092	0,034917	0,001473			

Analytische Funktion / Analytical function:

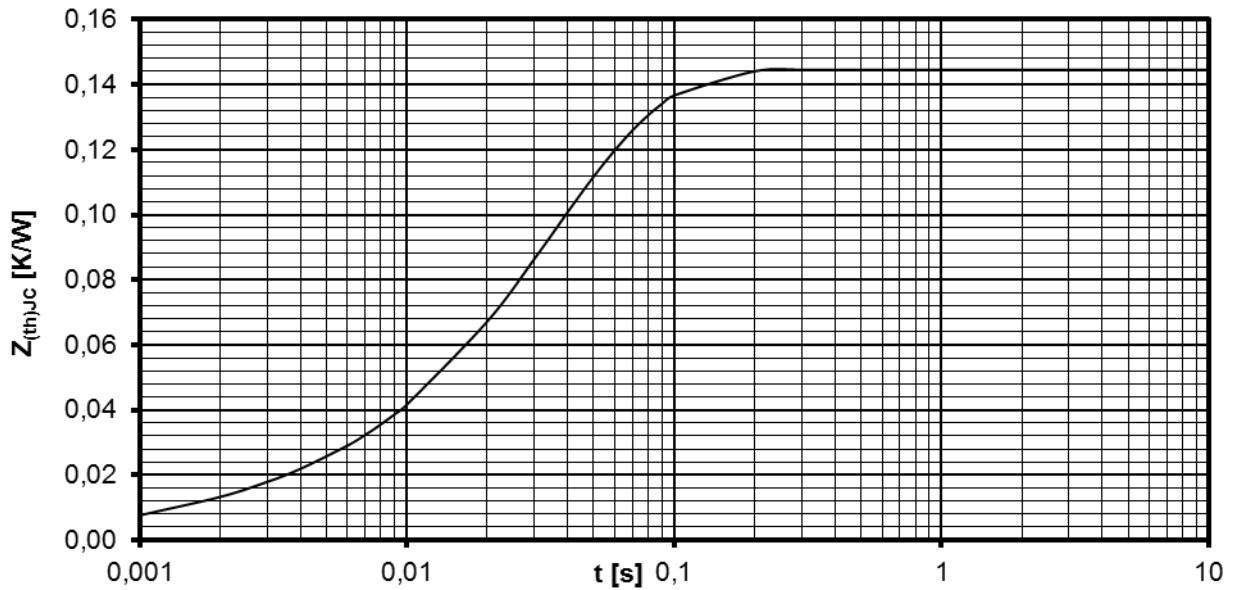
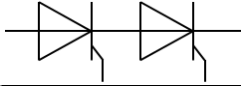
$$Z_{thJC} = \sum_{n=1}^{n_{max}} R_{thn} \left( 1 - e^{-\frac{t}{\tau_n}} \right)$$

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

	$\Theta = 180^\circ$	$\Theta = 120^\circ$	$\Theta = 90^\circ$	$\Theta = 60^\circ$	$\Theta = 30^\circ$
$\Delta Z_{th \Theta rec}$ [K/W]	0,02709	0,04187	0,05259	0,06819	0,09344
$\Delta Z_{th \Theta sin}$ [K/W]	0,02071	0,02767	0,03665	0,05160	0,08004

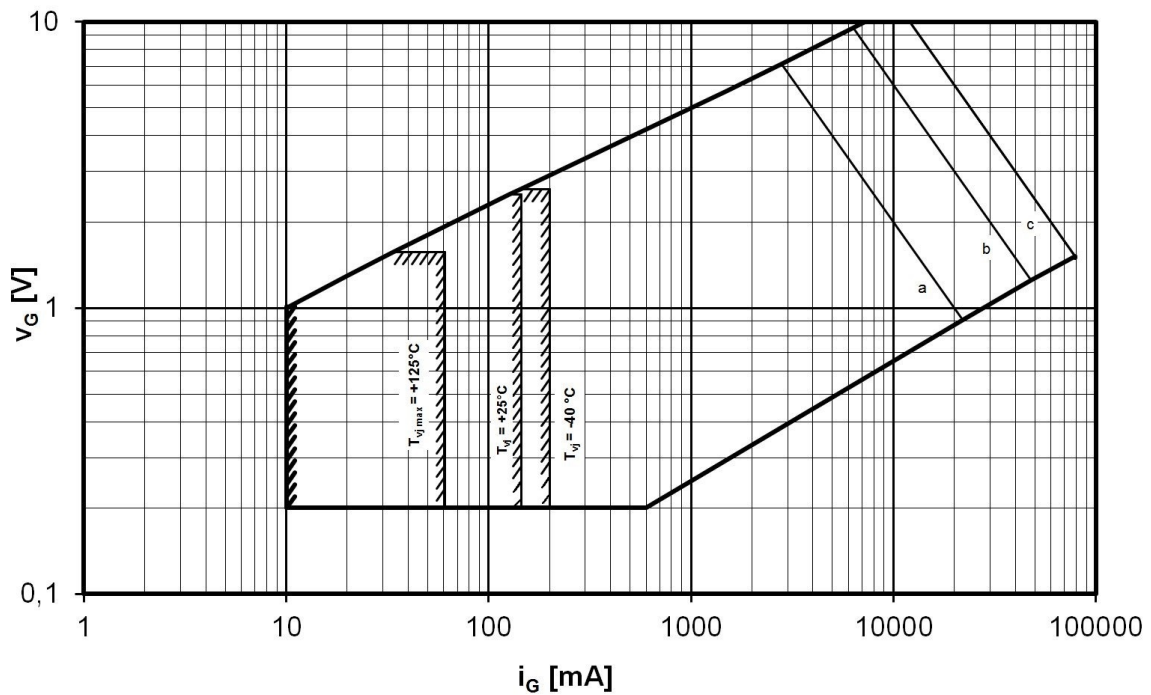
$$Z_{th \Theta rec} = Z_{thDC} + \Delta Z_{th \Theta rec}$$

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



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

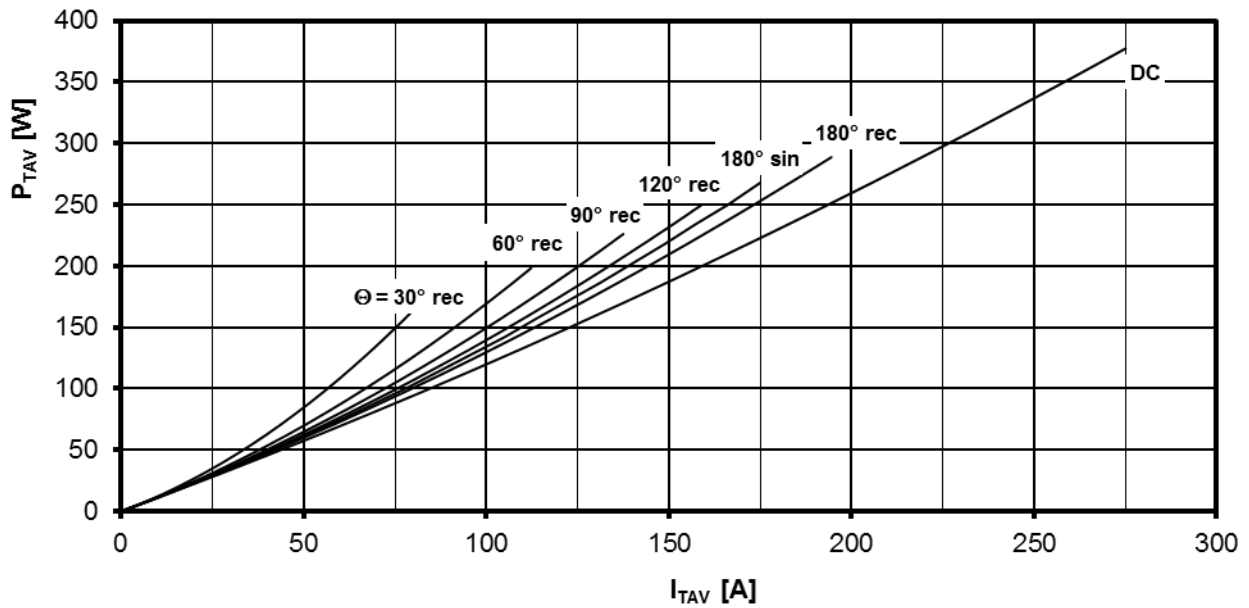
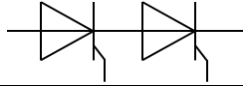
Parameter: Stromflußwinkel  $\Theta$  / Current conduction angle  $\Theta$



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 - 60W/500 $\mu$ s    c - 120W/30 $\mu$ s

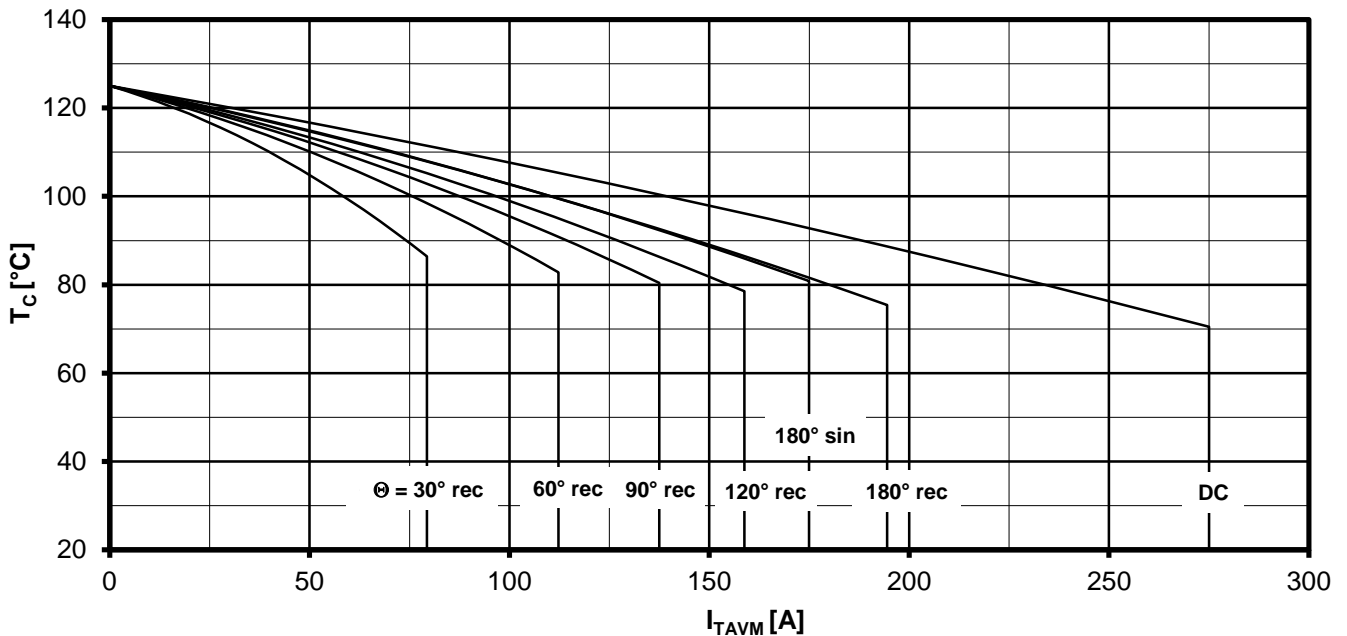


Durchlassverlustleistung je Zweig / On-state power loss per arm  $P_{TAV} = f(I_{TAV})$

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  $\Theta$

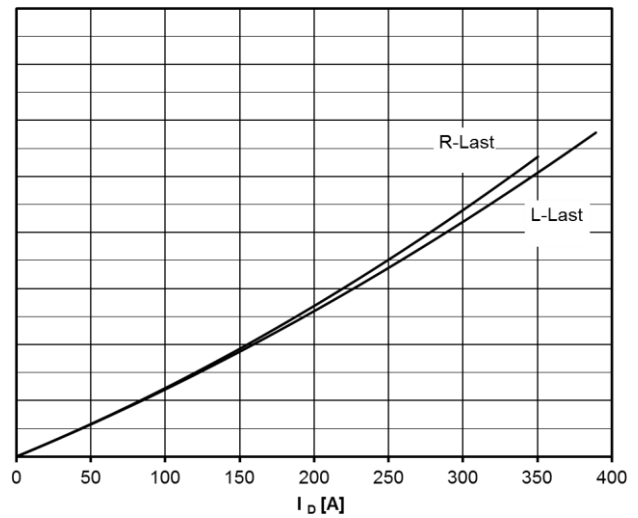
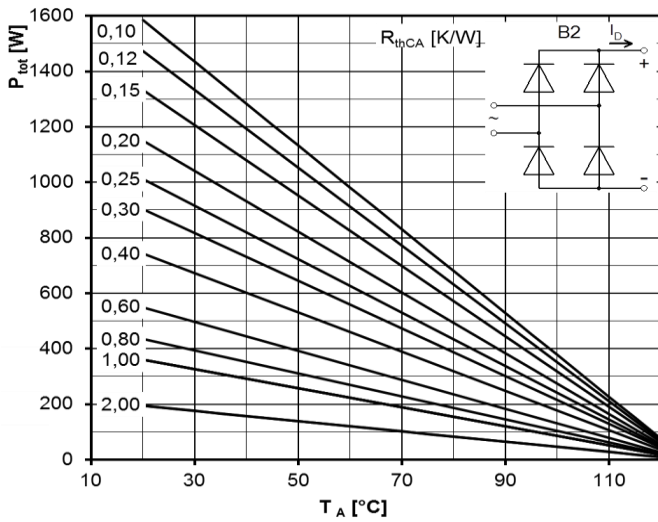
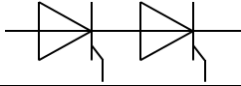


Höchstzulässige Gehäusetemperatur / Maximum allowable case temperature  $T_c = f(I_{TAVM})$

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  $\Theta$  / Current conduction angle  $\Theta$



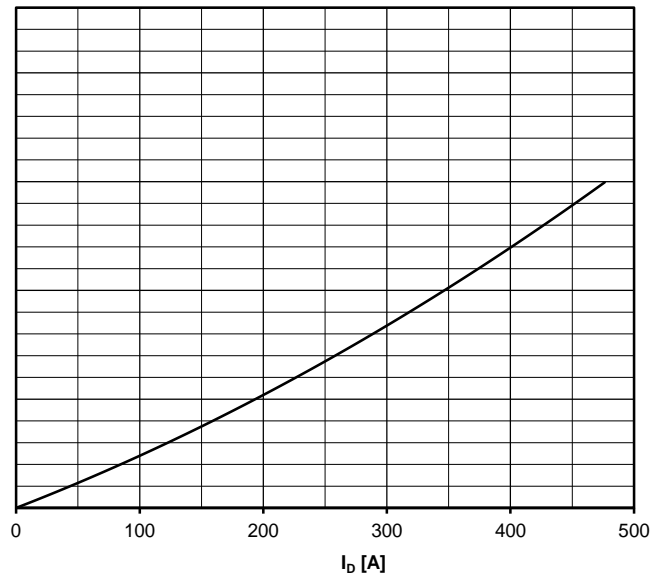
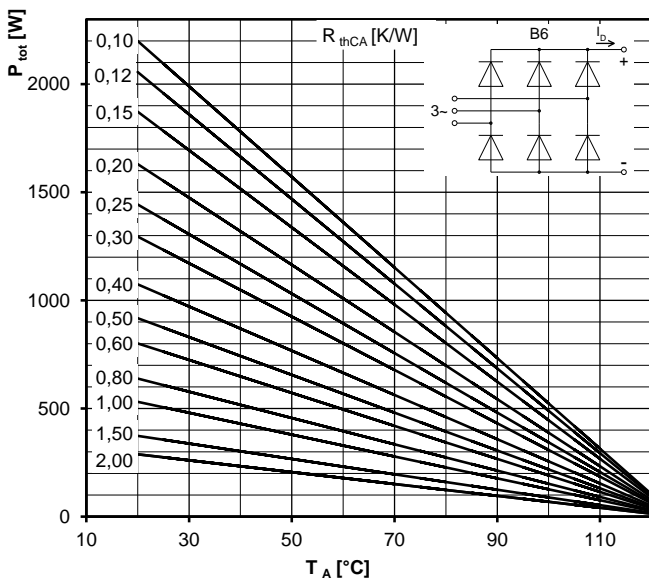
**Höchstzulässiger Ausgangsstrom / Maximum rated output current  $I_D$**

B2- Zweipuls-Brückenschaltung / Two-pulse bridge circuit

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

Parameter:

Wärmewiderstand pro Element zwischen den Gehäusen und Umgebung /  
Thermal resistance per chip cases to ambient  $R_{thCA}$



**Höchstzulässiger Ausgangsstrom / Maximum rated output current  $I_D$**

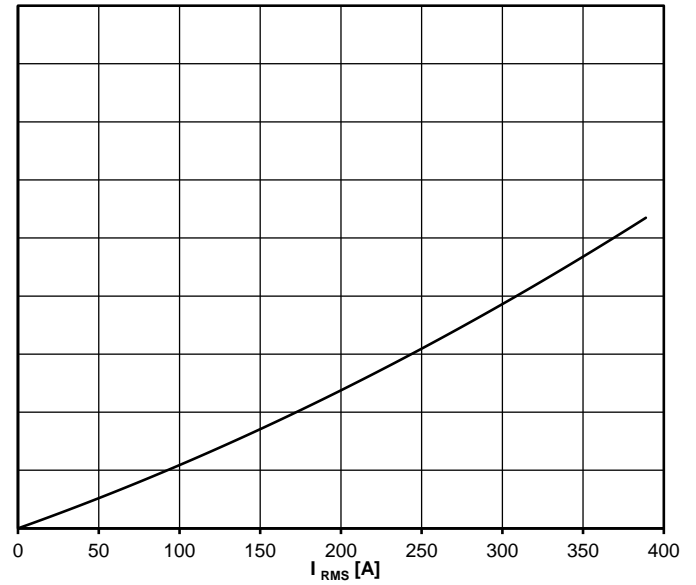
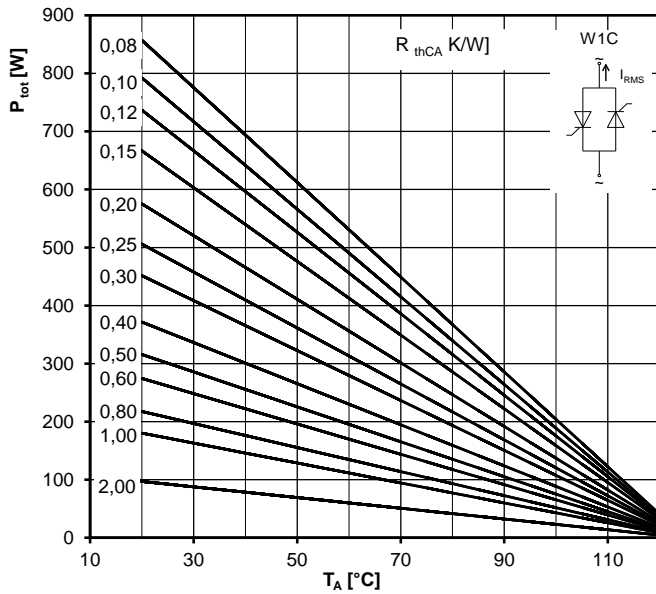
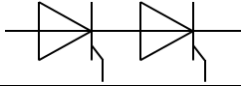
B6- Sechspuls-Brückenschaltung / Six-pulse bridge circuit

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

Parameter:

Wärmewiderstand pro Element zwischen den Gehäusen und Umgebung /  
Thermal resistance per chip cases to ambient  $R_{thCA}$





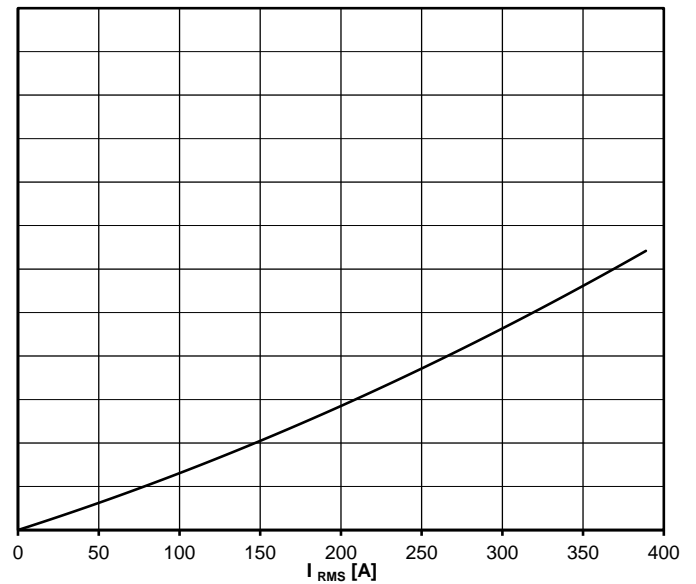
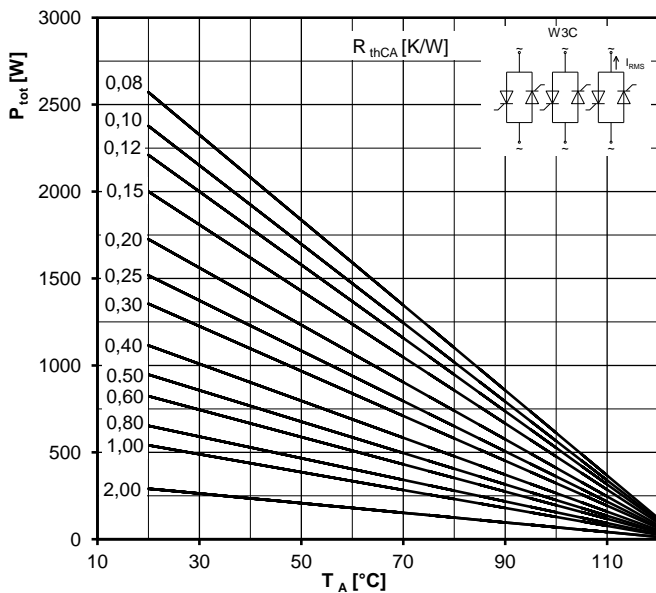
Höchstzulässiger Effektivstrom / Maximum rated RMS current  $I_{RMS}$

W1C - Einphasen-Wechselwegschaltung / Single-phase inverse parallel circuit

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

Parameter:

Wärmewiderstand pro Element zwischen den Gehäusen und Umgebung /  
Thermal resistance per chip cases to ambient  $R_{thCA}$



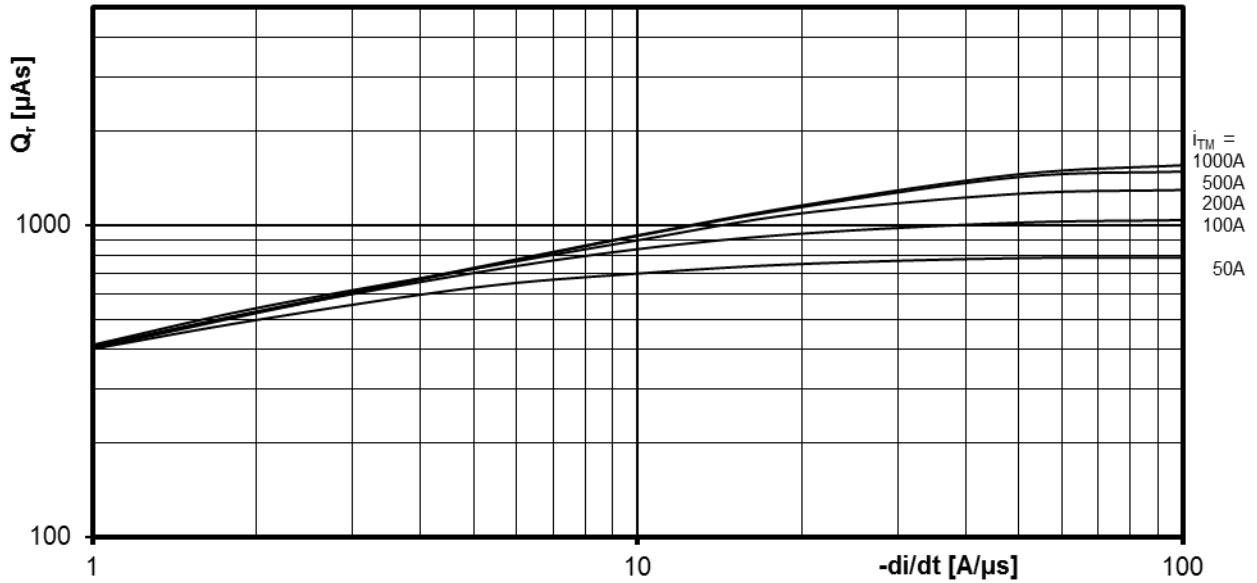
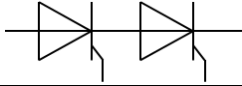
Höchstzulässiger Effektivstrom / Maximum rated RMS current  $I_{RMS}$

W3C - Dreiphasen-Wechselwegschaltung / Three-phase inverse parallel circuit

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

Parameter:

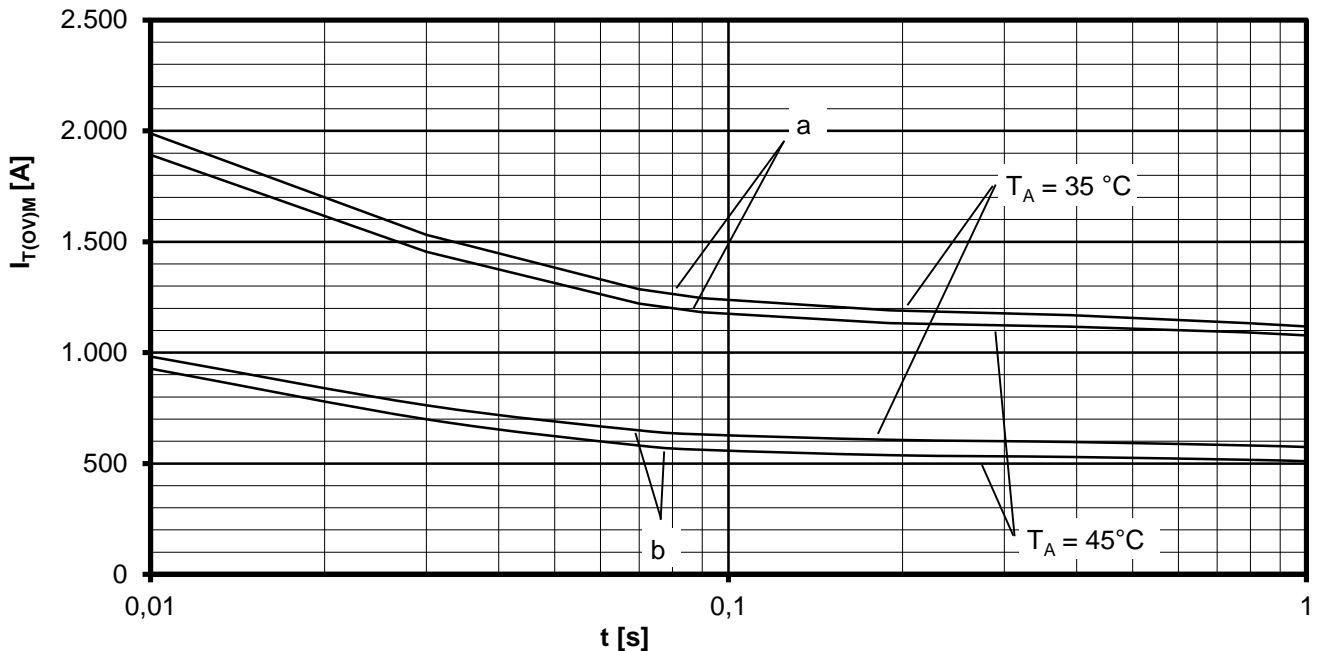
Wärmewiderstand pro Element zwischen den Gehäusen und Umgebung /  
Thermal resistance per chip cases to ambient  $R_{thCA}$



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