

Key Parameters

| | |
|---------------------|--|
| V_{DRM} / V_{RRM} | 1600 V |
| I_{TAVM} | 160 A ($T_C=85\text{ }^\circ\text{C}$) |
| I_{TSM} | 5200 A |
| V_{T0} | 1,1 V |
| r_T | 0,99 m Ω |
| 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

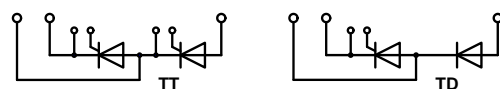
Typische Anwendungen

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

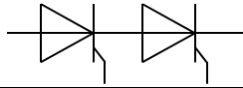
Typical Applications

- 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 |



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Technische Information / technical information



Netz-Thyristor-Modul
Phase Control Thyristor Module

TT160N16SOF

Infineon Technologies Bipolar
GmbH & Co. KG

TT160N16SOF

TD160N16SOF

Elektrische Eigenschaften / Electrical properties

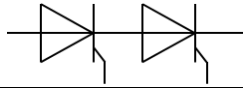
Höchstzulässige Werte / Maximum rated values

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

Charakteristische Werte / Characteristic values

| | | | | |
|---|--|------------------------------|-------------------|----------------------------|
| Durchlaßspannung on-state voltage | $T_{vj} = T_{vj\text{max}}, I_{\text{T}} = 500\text{A}$ | V_{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_{T} | max. 0,99 | $\text{m}\Omega$ |
| Zündstrom gate trigger current | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}$ | I_{GT} | max. 145 | 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. 10 max. 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 | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}, R_{\text{A}} = 1\Omega$ | I_{H} | max. 200 | 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_{L} | max. 400 | 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 | 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. 2 | μs |

| | |
|-----------------|---------------------------------|
| 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

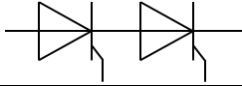
| | | | | | |
|--|--|------------|------|------------|---------------|
| Freiwerdezeit circuit commutated turn-off time | $T_{vj} = T_{vj\max}$, $i_{TM} = I_{TAVM}$ $V_{RM} = 100\text{ V}$, $v_{DM} = 0,67 V_{DRM}$ $dv_D/dt = 20\text{ V}/\mu\text{s}$, $-di_T/dt = 10\text{ A}/\mu\text{s}$ 5.Kennbuchstabe / 5 th letter O | t_q | typ. | 320 | 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. | 0,0825 | 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 | Basisisolierung (Schutzklasse 1, EN61140) Basic insulation (class 1, IEC61140) | | | Al_2O_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 | m/s^2 |
|  | file-No. | | | E 83335 | |



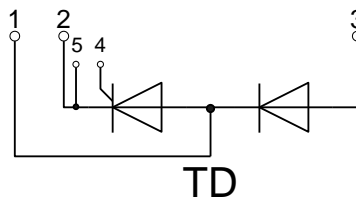
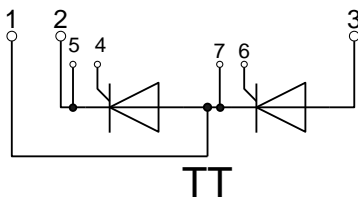
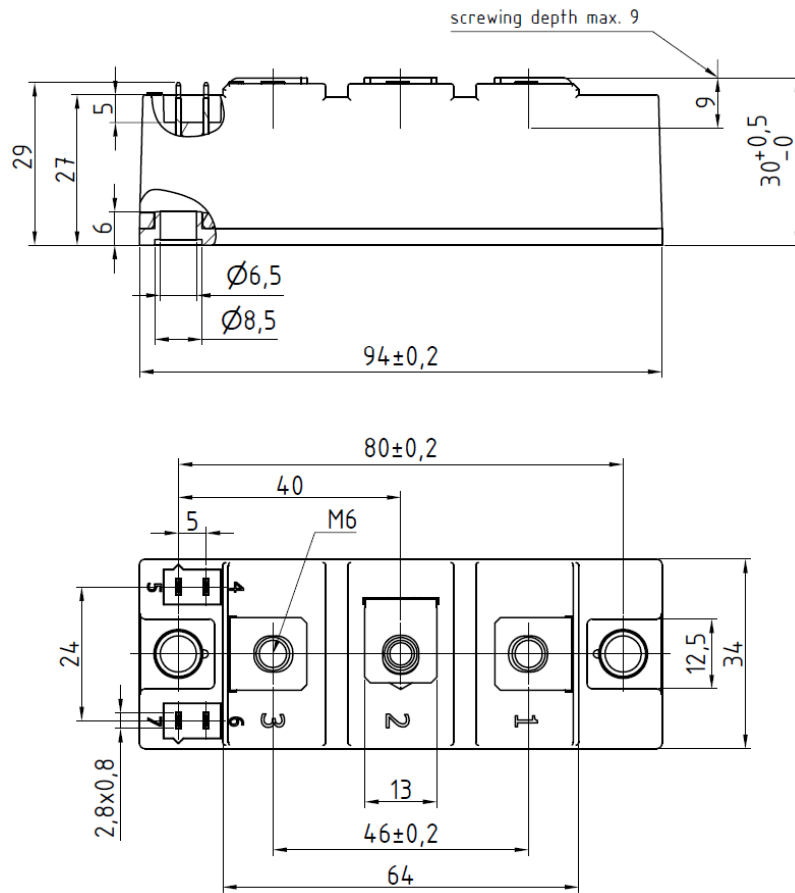
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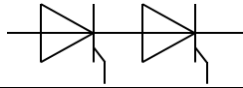


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Analytische Elemente des transienten Wärmewiderstandes Z_{thJC} für DC
Analytical elements of transient thermal impedance Z_{thJC} for DC

| Pos. n | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------------|----------|-----------|-----------|-----------|---|---|---|
| R_{thn} [K/W] | 0,0669 | 0,0024648 | 0,0674976 | 0,0076896 | | | |
| τ_n [s] | 0,035107 | 0,035092 | 0,034917 | 0,001473 | | | |

Analytische Funktion / Analytical function:

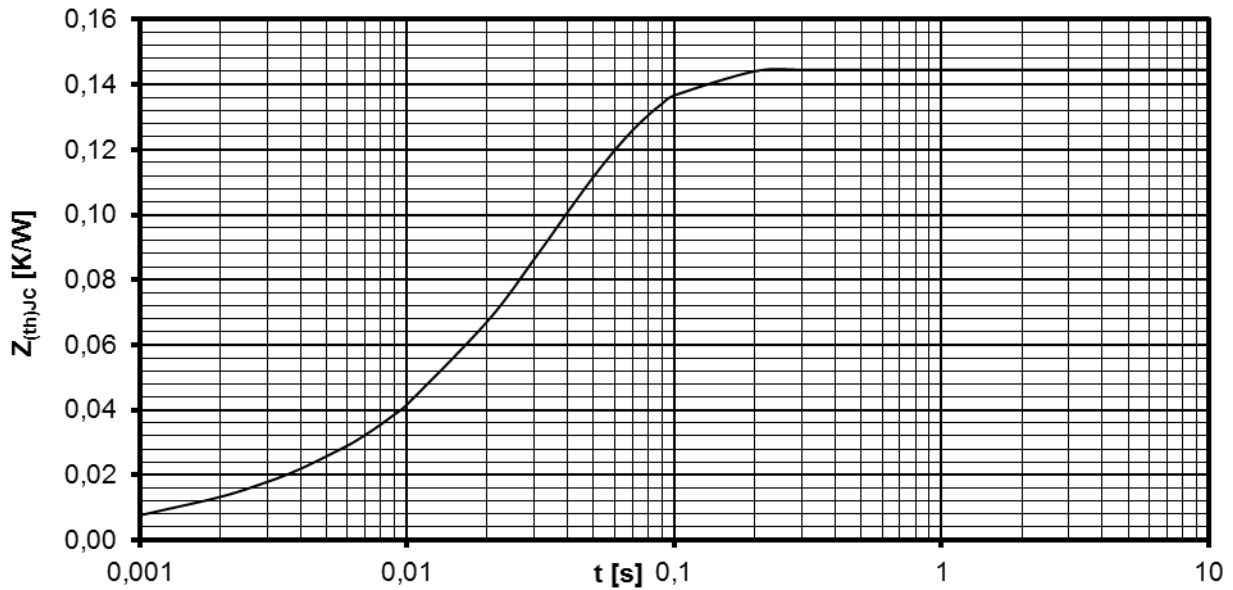
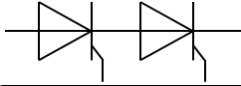
$$Z_{thJC} = \sum_{n=1}^{n_{max}} R_{thn} \left(1 - e^{-\frac{t}{\tau_n}} \right)$$

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

| | $\Theta = 180^\circ$ | $\Theta = 120^\circ$ | $\Theta = 90^\circ$ | $\Theta = 60^\circ$ | $\Theta = 30^\circ$ |
|----------------------------------|----------------------|----------------------|---------------------|---------------------|---------------------|
| $\Delta Z_{th \Theta rec}$ [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 |

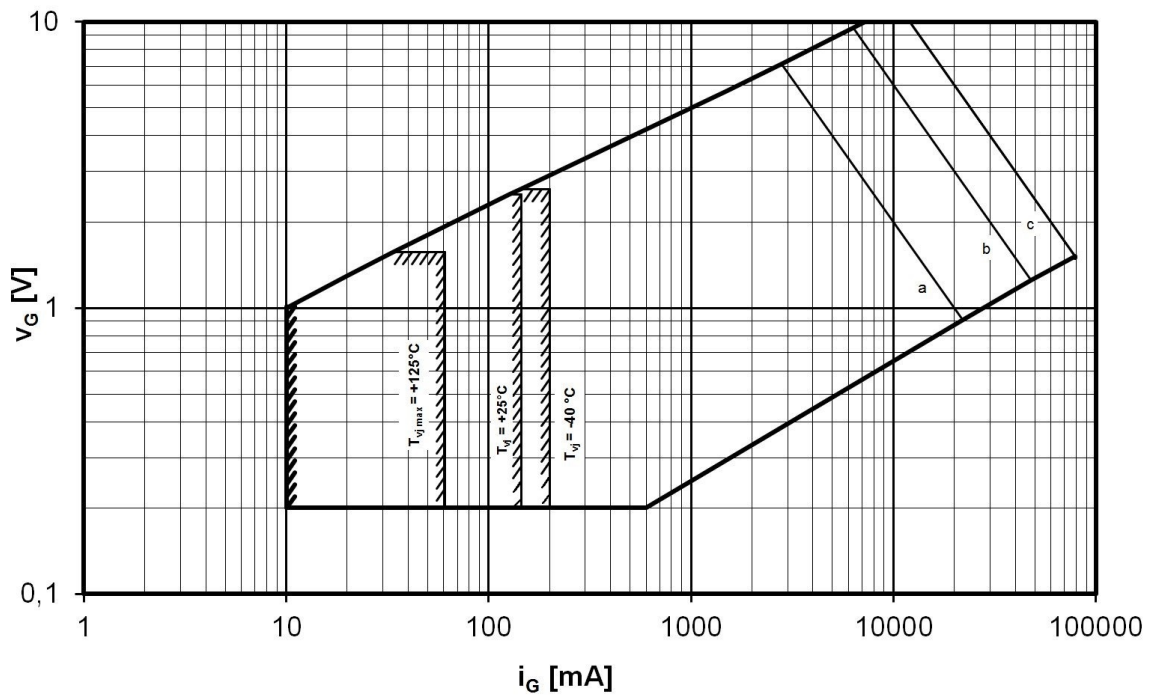
$$Z_{th \Theta rec} = Z_{thDC} + \Delta Z_{th \Theta rec}$$

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



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

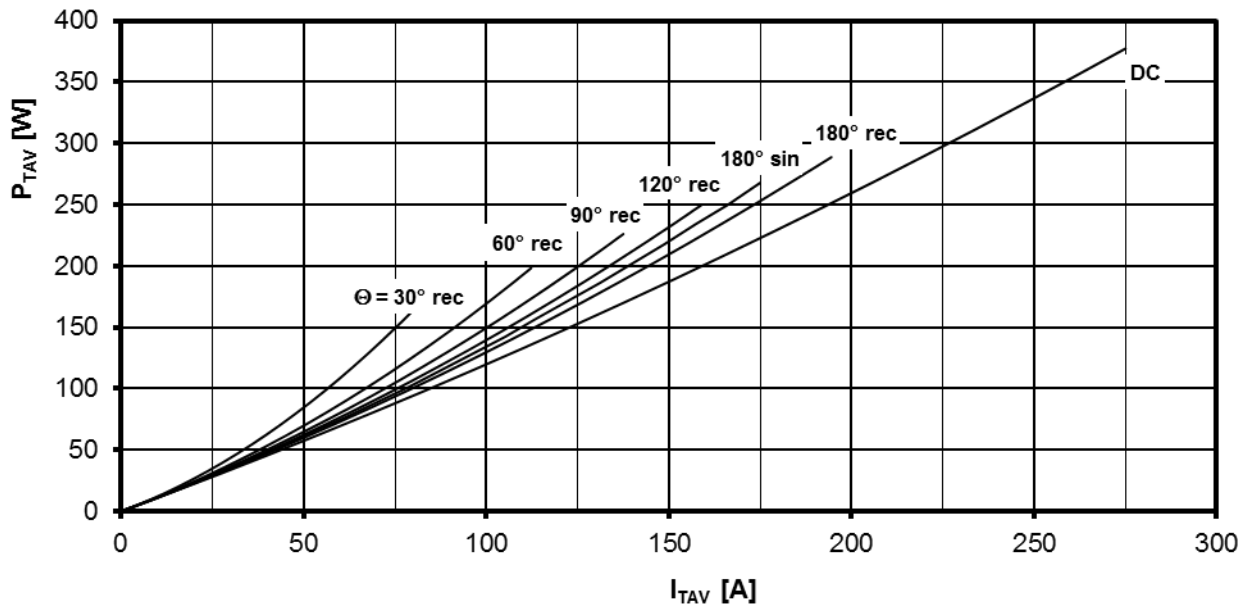
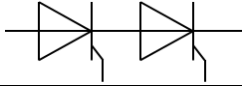
Parameter: Stromflußwinkel Θ / Current conduction angle Θ



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 μ s c - 120W/30 μ s

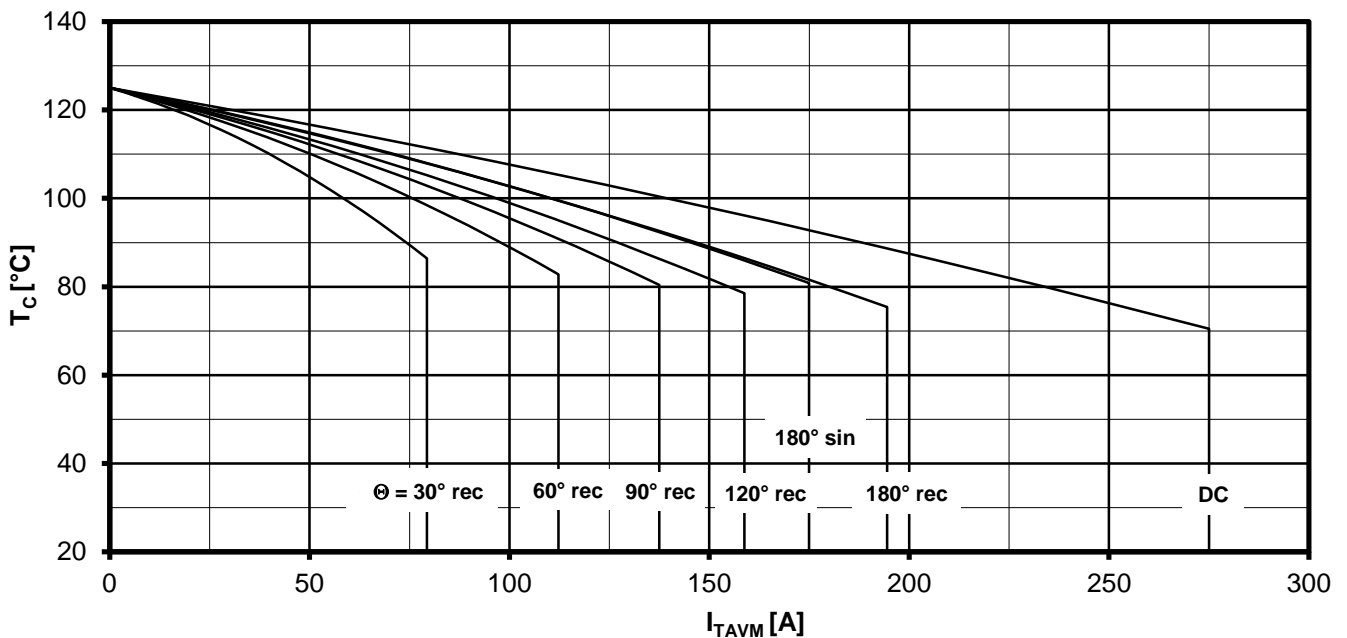


Durchlassverlustleistung je Zweig / On-state power loss per arm $P_{TAV} = f(I_{TAV})$

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 Θ

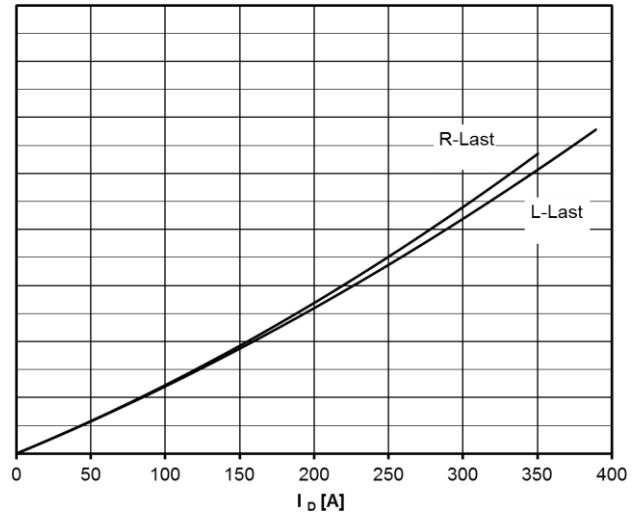
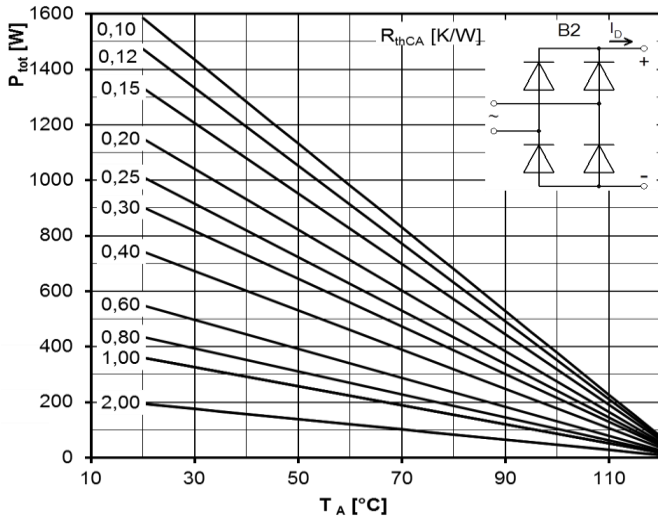
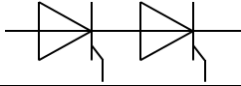


Höchstzulässige Gehäusetemperatur / Maximum allowable case temperature $T_c = f(I_{TAVM})$

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 Θ / Current conduction angle Θ



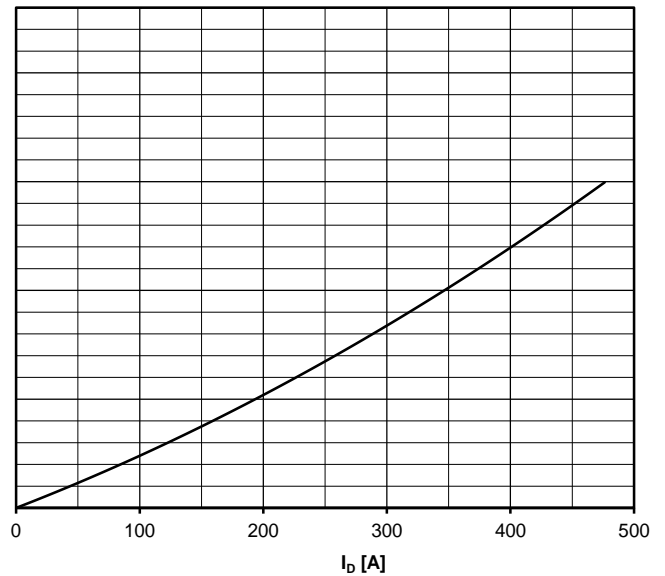
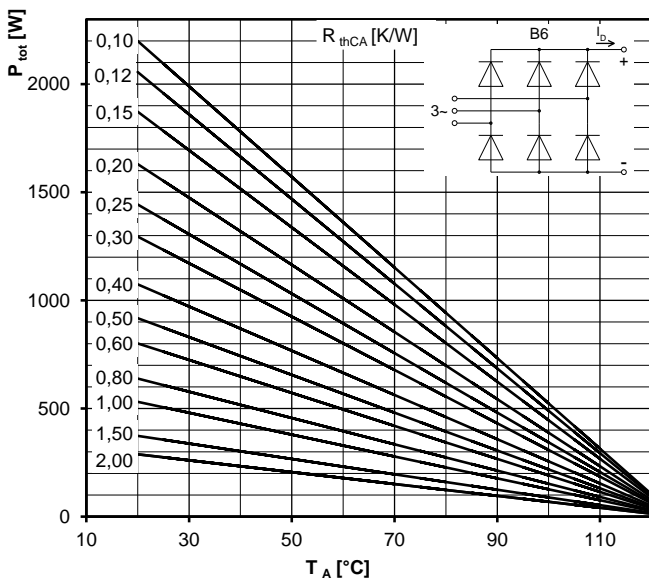
Höchstzulässiger Ausgangsstrom / Maximum rated output current I_D

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}



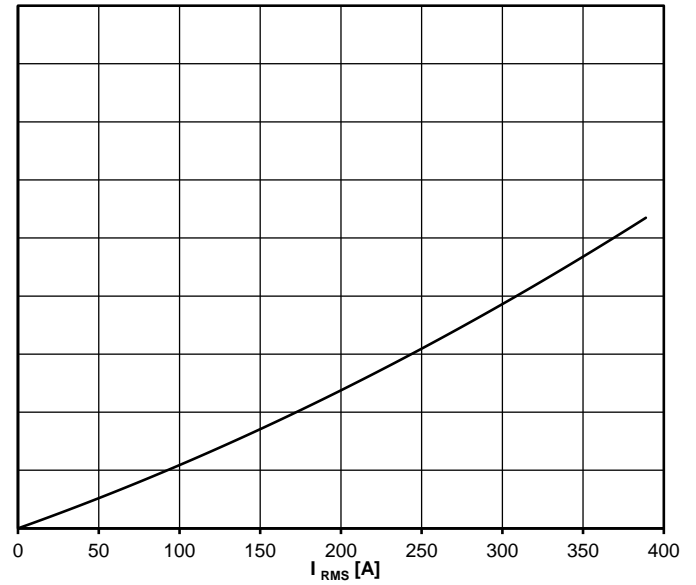
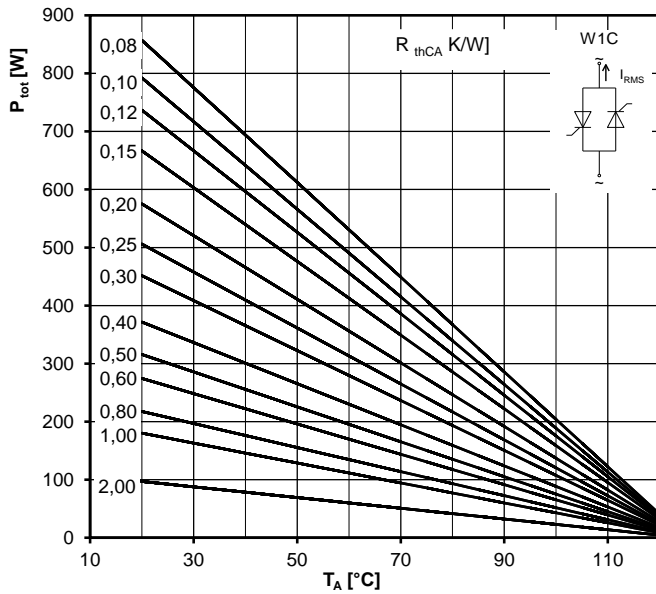
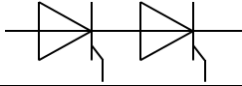
Höchstzulässiger Ausgangsstrom / Maximum rated output current I_D

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}



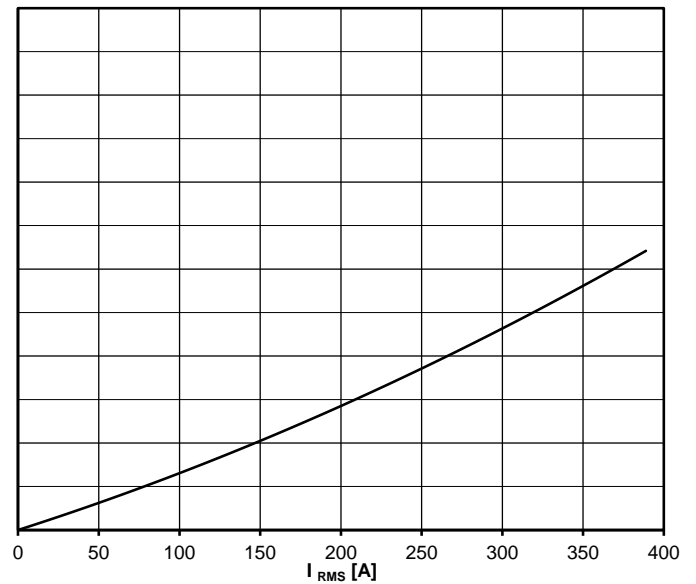
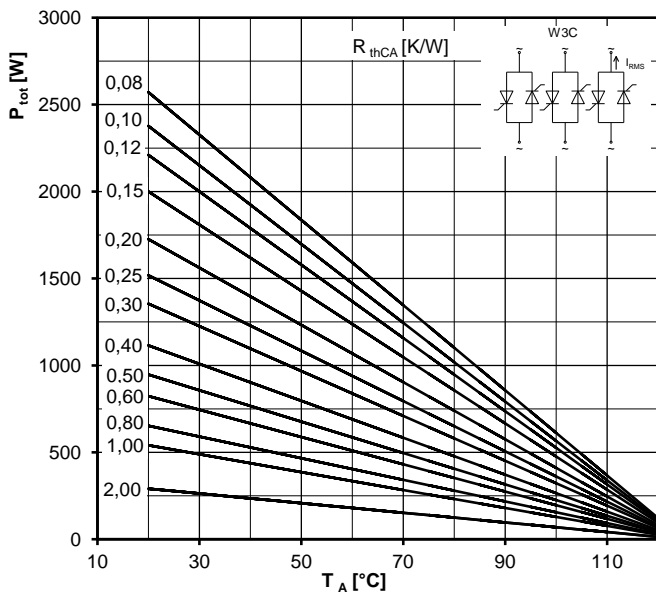
Höchstzulässiger Effektivstrom / Maximum rated RMS current I_{RMS}

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}



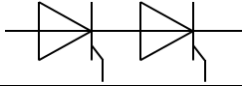
Höchstzulässiger Effektivstrom / Maximum rated RMS current I_{RMS}

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

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

Parameter:

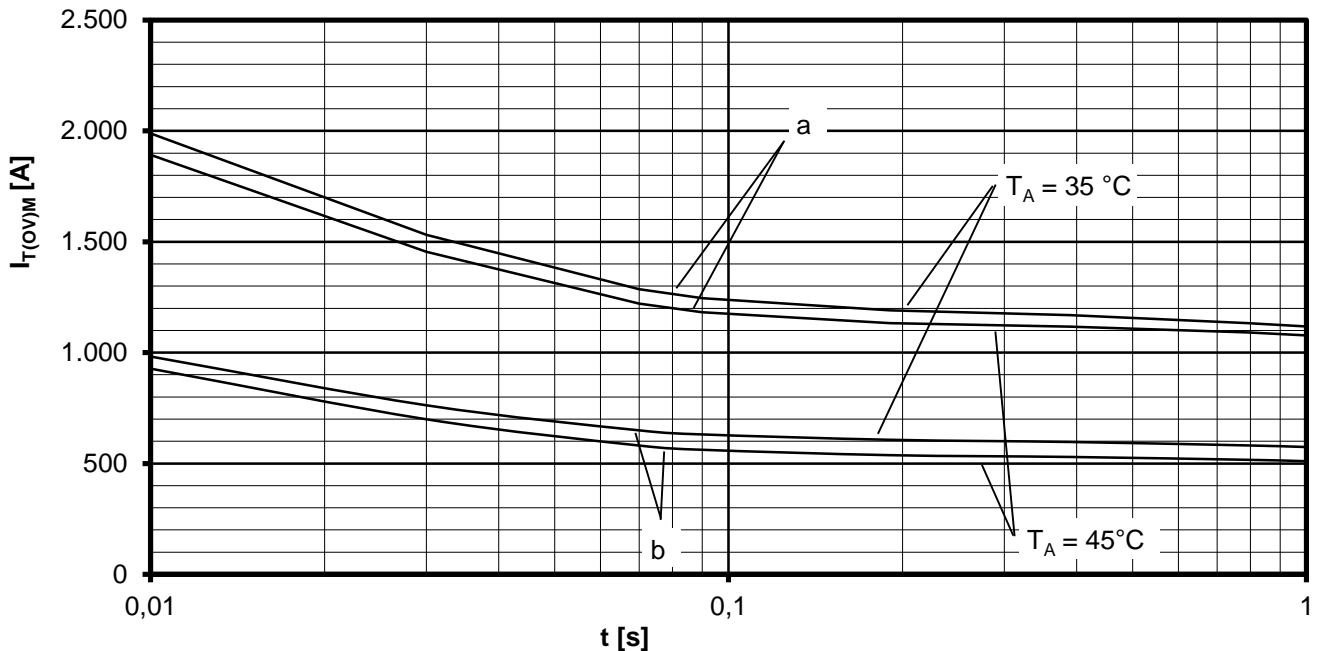
Wärmewiderstand pro Element zwischen den Gehäusen und Umgebung /
Thermal resistance per chip cases to ambient R_{thCA}



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