

Technische Information / technical information



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

TT215N

Infineon Technologies Bipolar
GmbH & Co. KG

Key Parameters

| | |
|---------------------|--|
| V_{DRM} / V_{RRM} | 1800 – 2200 V |
| I_{TAVM} | 215 A ($T_C=85\text{ }^\circ\text{C}$) |
| I_{TSM} | 7000 A |
| V_{T0} | 0,95 V |
| r_T | 0,92 m Ω |
| R_{thJC} | 0,124 K/W |
| Base plate | 50 mm |
| Weight | 800 g |



For type designation please refer to actual short form catalog

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

Merkmale

- Druckkontakt-Technologie für hohe Zuverlässigkeit
- Advanced Medium Power Technology (AMPT)
- Industrie-Standard-Gehäuse
- Elektrisch isolierte Bodenplatte
- *Optional: Thermisches Interface Material (TIM) bereits aufgetragen*

Features

- Pressure contact technology for high reliability
- Advanced Medium Power Technology (AMPT)
- Industrial standard package
- Electrically insulated base plate
- *Option: Pre-applied thermal interface material (TIM)*

Typische Anwendungen

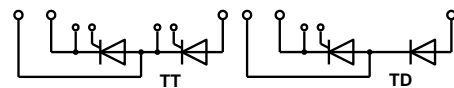
- Sanftanlasser
- Gleichrichter für Antriebsapplikationen
- Kurzschließer-Applikationen
- Leistungssteller
- Gleichrichter für UPS
- Batterieladegleichrichter
- Statische Umschalter

Typical Applications

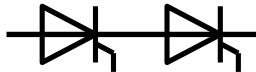
- Soft starter
- Rectifier for drives applications
- Crowbar applications
- Power controllers
- Rectifiers for UBS
- Battery chargers
- Static switches



| content of customer DMX code | DMX code digit | DMX code digit quantity |
|----------------------------------|----------------|-------------------------|
| serial number | 1..5 | 5 |
| SAP material number | 6..12 | 7 |
| Internal production order number | 13..20 | 8 |
| datecode (production year) | 21..22 | 2 |
| datecode (production week) | 23..24 | 2 |



www.ifbip.com
support@infineon-bip.com



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TD215N

TD215N22KOF_TIM

Elektrische Eigenschaften / Electrical properties

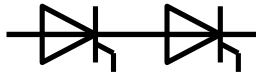
Höchstzulässige Werte / Maximum rated values

| | TT215N | TD215N | TD215N22KOF_TIM |
|--|---|----------------------------------|--|
| Periodische Vorwärts- und Rückwärts-Spitzensperrspannung repetitive peak forward off-state and reverse voltages | $T_{vj} = -40^{\circ}\text{C} \dots T_{vj\text{max}}$ | $V_{\text{DRM}}, V_{\text{RRM}}$ | 1800 V 2000 V 2200 V |
| Vorwärts-Stoßspitzensperrspannung non-repetitive peak forward off-state voltage | $T_{vj} = -40^{\circ}\text{C} \dots T_{vj\text{max}}$ | V_{DSM} | 1800 V 2000 V 2200 V |
| Rückwärts-Stoßspitzensperrspannung non-repetitive peak reverse voltage | $T_{vj} = +25^{\circ}\text{C} \dots T_{vj\text{max}}$ | V_{RSM} | 1900 V 2100 V 2300 V |
| Durchlaßstrom-Grenzeffektivwert maximum RMS on-state current | | I_{TRMSM} | 410 A |
| Dauergrenzstrom average on-state current | $T_C = 85^{\circ}\text{C}$ | I_{TAVM} | 215 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} | 7000 A 6300 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 | 245000 A ² s 198000 A ² 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 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 | $T_{vj} = T_{vj\text{max}}, i_{\text{T}} = 800\text{A}$ | V_{T} | max. 1,8 V |
| Schleusenspannung threshold voltage | $T_{vj} = T_{vj\text{max}}$ | $V_{(\text{TO})}$ | max. 0,95 V |
| Ersatzwiderstand slope resistance | $T_{vj} = T_{vj\text{max}}$ | r_{T} | max. 0,92 m Ω |
| Zündstrom gate trigger current | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}$ | I_{GT} | max. 200 mA |
| Zündspannung gate trigger voltage | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}$ | V_{GT} | max. 2,0 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 mA max. 5 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. 300 mA |
| Einraststrom latching current | $T_{vj} = 25^{\circ}\text{C}, V_{\text{D}} = 12\text{V}, R_{\text{GK}} \geq 10\Omega$ $i_{\text{GM}} = 1\text{A}, di_{\text{G}}/dt = 1\text{A}/\mu\text{s}, t_{\text{g}} = 20\mu\text{s}$ | 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. 50 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. 4 μs |

| | | |
|-----------------|--|---------------------------------|
| prepared by: AG | | date of publication: 2019-08-16 |
| approved by: ML | | revision: 3.1 |



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Elektrische Eigenschaften / Electrical properties


Charakteristische Werte / Characteristic values

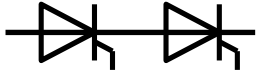
| | | | | | |
|--|---|------------|------|------------|---------------|
| Freiwerdezeit circuit commutated turn-off time | $T_{vj} = T_{vj\max}$, $i_{TM} = I_{TAVM}$ $V_{RM} = 100\text{ V}$, $v_{DM} = 0,67\text{ V}_{DRM}$ $dv_D/dt = 20\text{ V}/\mu\text{s}$, $-di_T/dt = 10\text{ A}/\mu\text{s}$ 5.Kennbuchstabe / 5 th letter O | t_q | typ. | 300 | 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. max. max. max. | 0,065 0,130 0,062 0,124 | K/W K/W K/W K/W |
| Übergangs-Wärmewiderstand thermal resistance, case to heatsink | pro Modul / per Module pro Zweig / per arm | R_{thCH} | max. max. | 0,02 0,04 | K/W K/W |
| <i>Übergangs-Wärmewiderstand mit TIM</i> <i>thermal resistance, case to heatsink, with TIM</i> | pro Modul / per Module pro Zweig / per arm | | max. max. | 0,015 0,030 | K/W 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...+130 | $^\circ\text{C}$ |
| <i>Lagertemperatur mit TIM</i> <i>storage temperature with TIM</i> | | | | +5...+40 | $^\circ\text{C}$ |

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 | Basisisolation (Schutzklasse 1, EN61140) Basic insulation (class 1, IEC61140) | | | 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 83335 | |



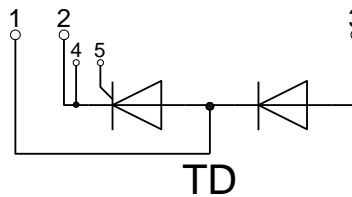
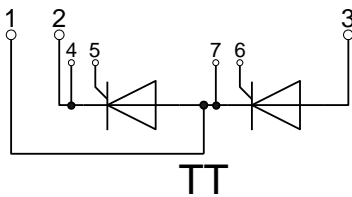
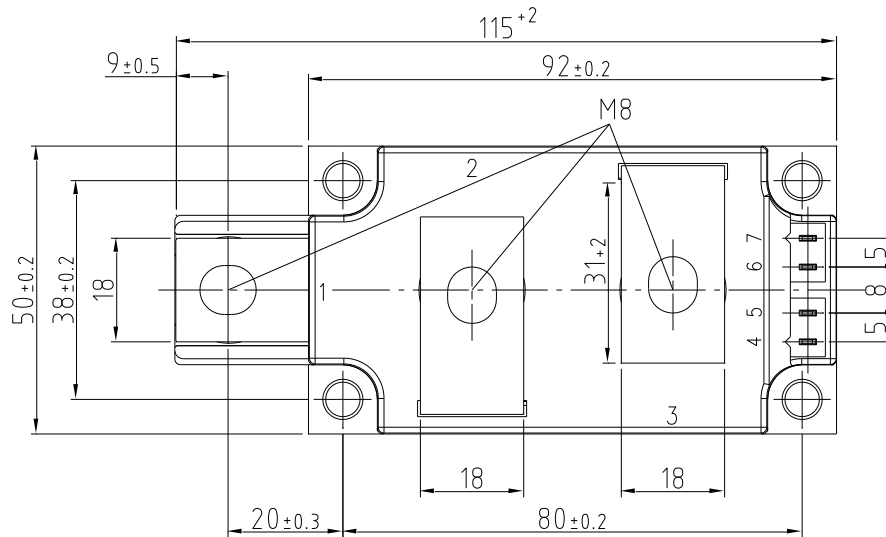
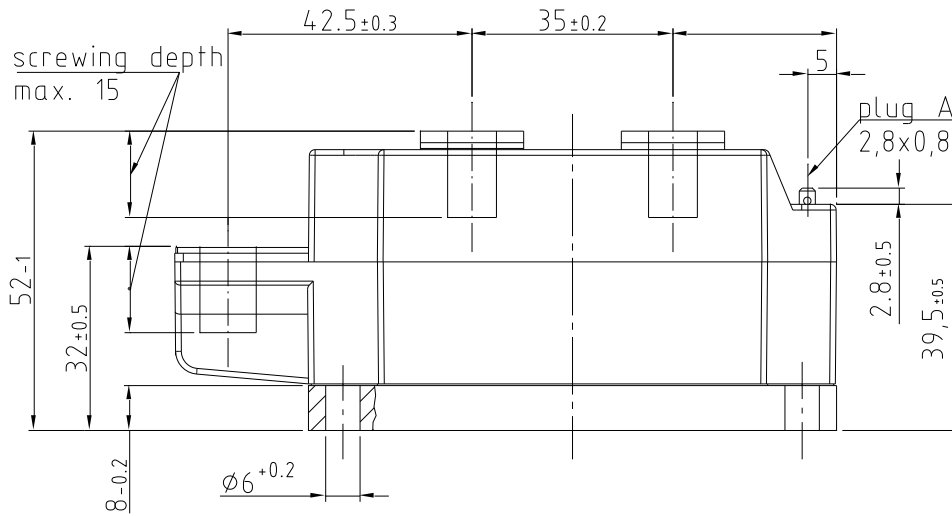
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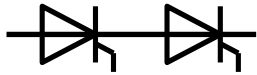


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Analytische Elemente des transienten Wärmewiderstandes Z_{thJC} für DC
Analytical elements of transient thermal impedance Z_{thJC} for DC

| Pos. n | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------------|--------|--------|--------|--------|--------|---|---|
| R_{thn} [K/W] | 0,0426 | 0,0429 | 0,0257 | 0,0097 | 0,0031 | | |
| τ_n [s] | 3,06 | 0,61 | 0,11 | 0,008 | 0,0009 | | |

Analytische Funktion / Analytical function:

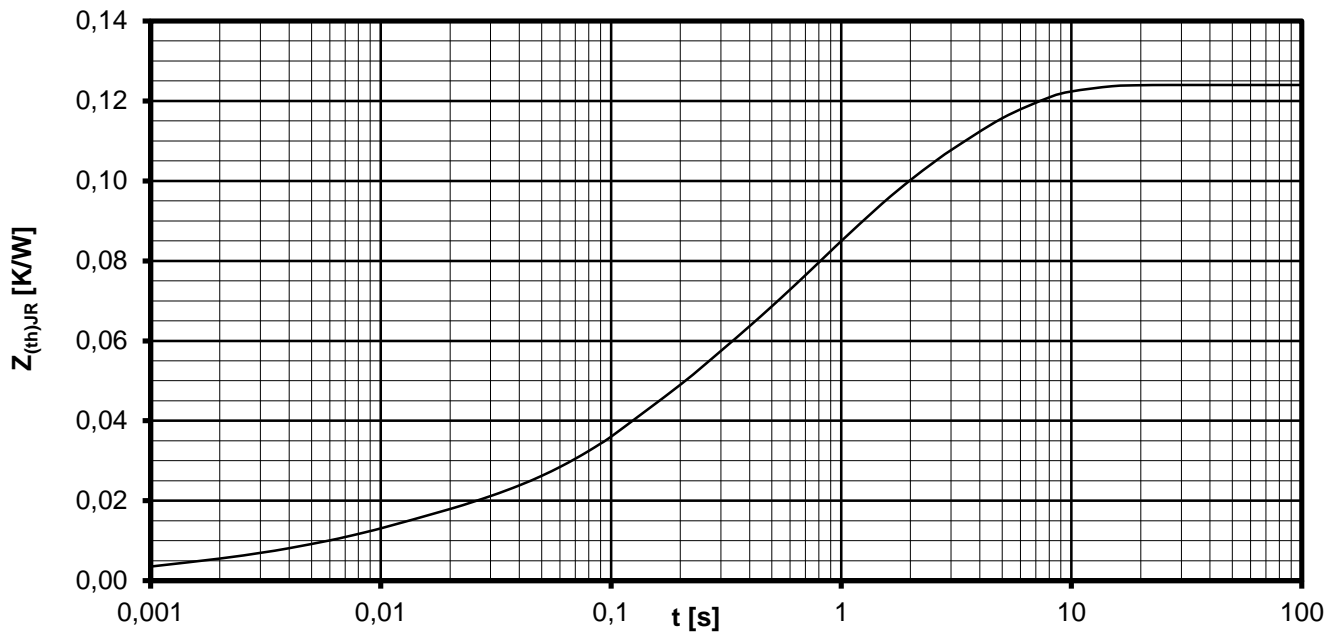
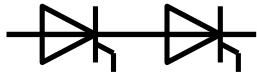
$$Z_{thJC} = \sum_{n=1}^{n_{max}} R_{thn} \left(1 - e^{-\frac{t}{\tau_n}} \right)$$

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

| | $\Theta = 180^\circ$ | $\Theta = 120^\circ$ | $\Theta = 90^\circ$ | $\Theta = 60^\circ$ | $\Theta = 30^\circ$ |
|----------------------------------|----------------------|----------------------|---------------------|---------------------|---------------------|
| $\Delta Z_{th \Theta rec}$ [K/W] | 0,01007 | 0,01655 | 0,02161 | 0,02981 | 0,04541 |
| $\Delta Z_{th \Theta sin}$ [K/W] | 0,00601 | 0,00869 | 0,01236 | 0,01905 | 0,03519 |

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

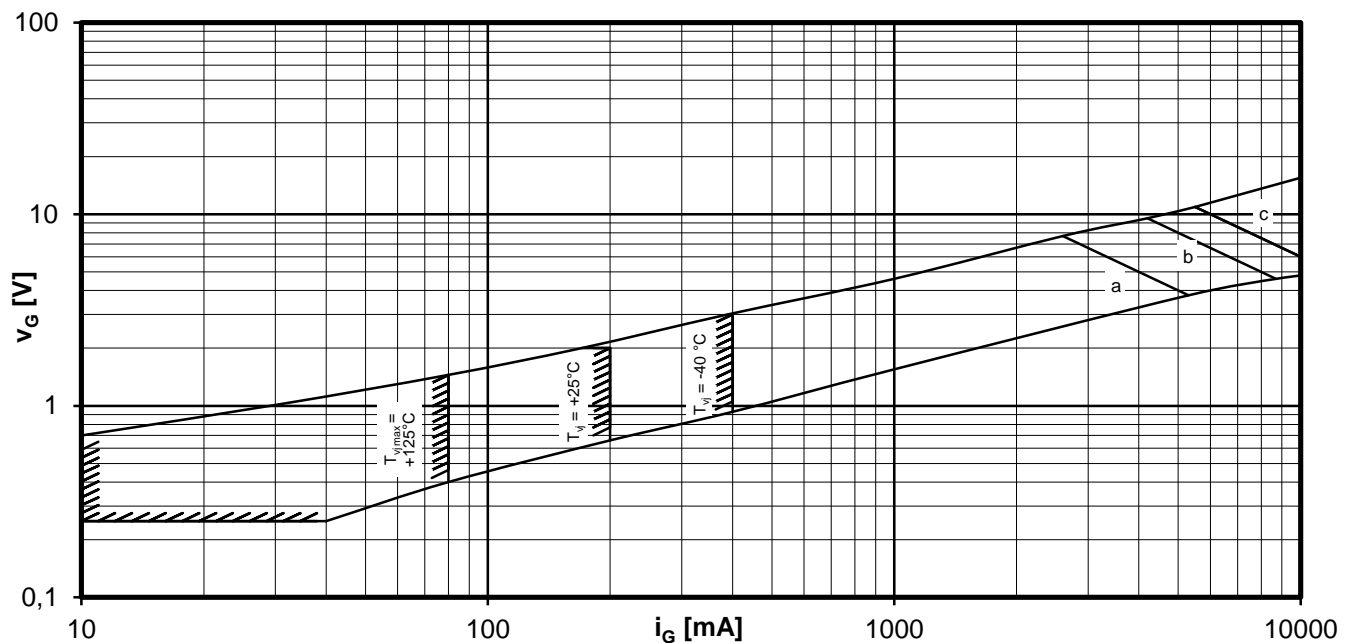
$$Z_{th \Theta sin} = Z_{th DC} + \Delta Z_{th \Theta sin}$$



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

Sinusförmiger Strom / Sinusoidal current

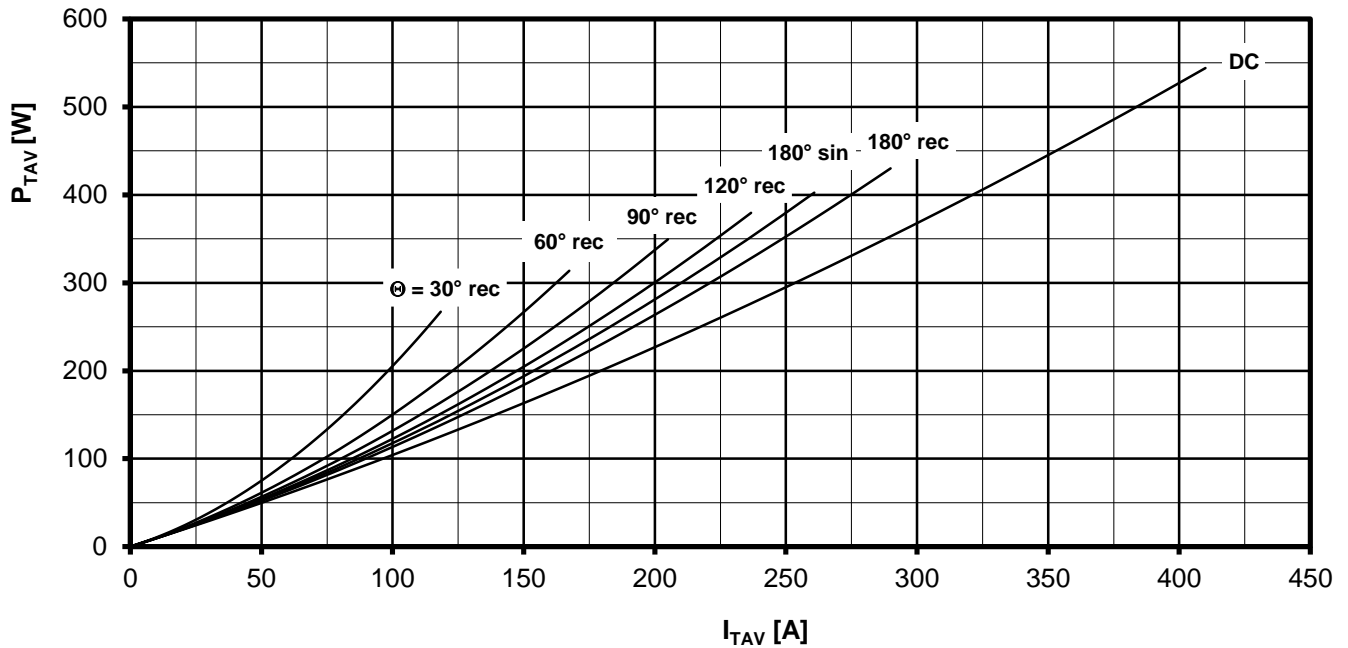
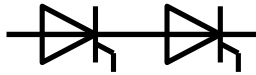
Parameter: Stromflußwinkel Θ / Current conduction angle Θ



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 - 40W/1ms c - 60W/0,5ms

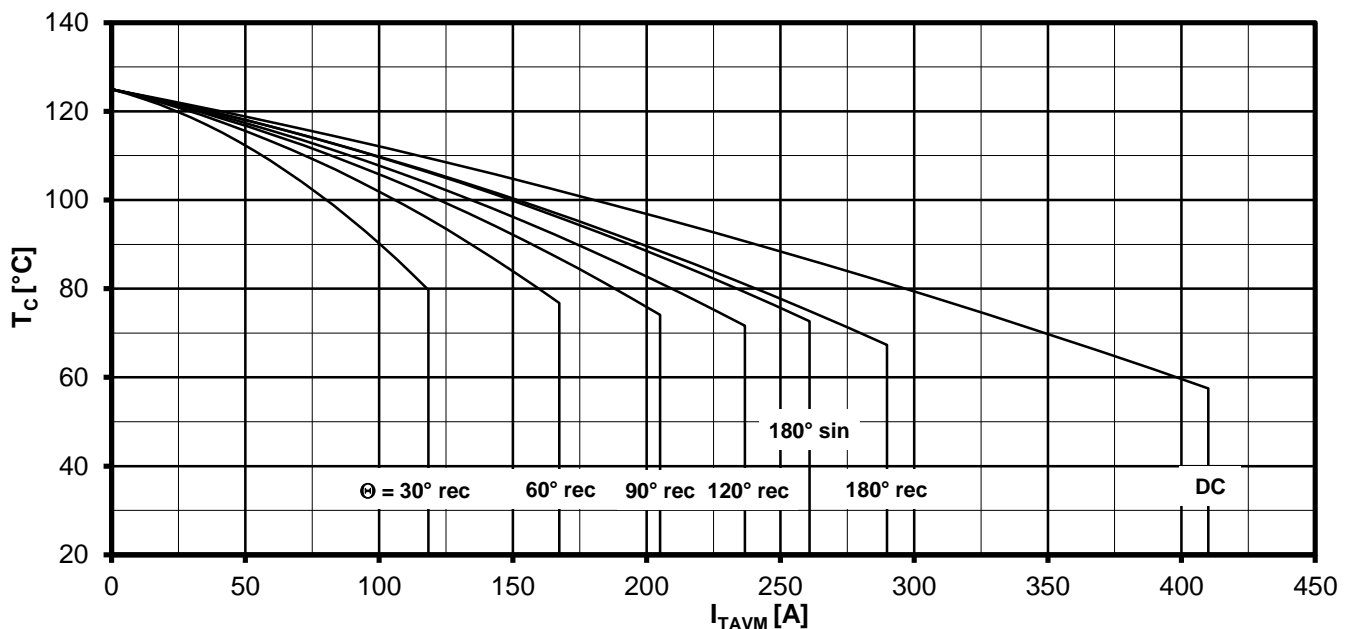


Durchlassverlustleistung je Zweig / On-state power loss per arm $P_{TAV} = f(I_{TAV})$

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

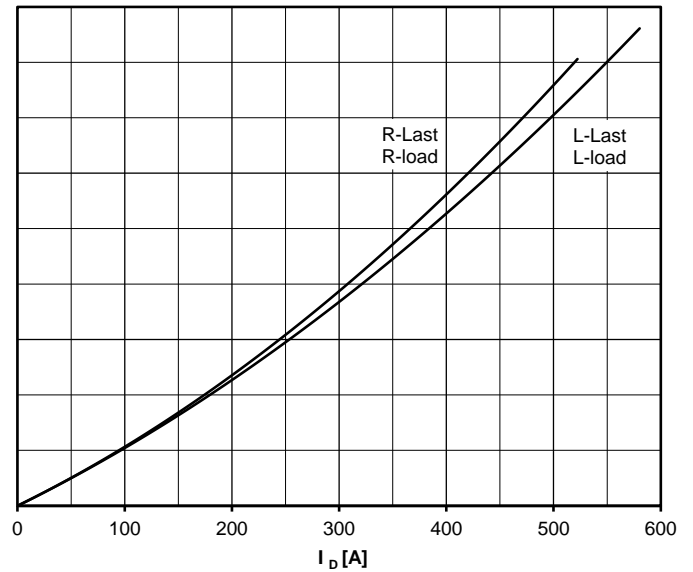
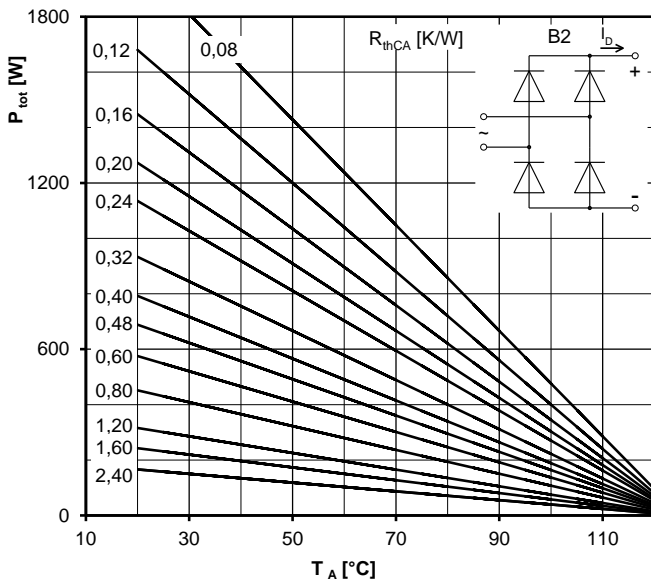
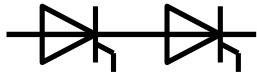


Höchstzulässige Gehäusetemperatur / Maximum allowable case temperature $T_c = f(I_{TAVM})$

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



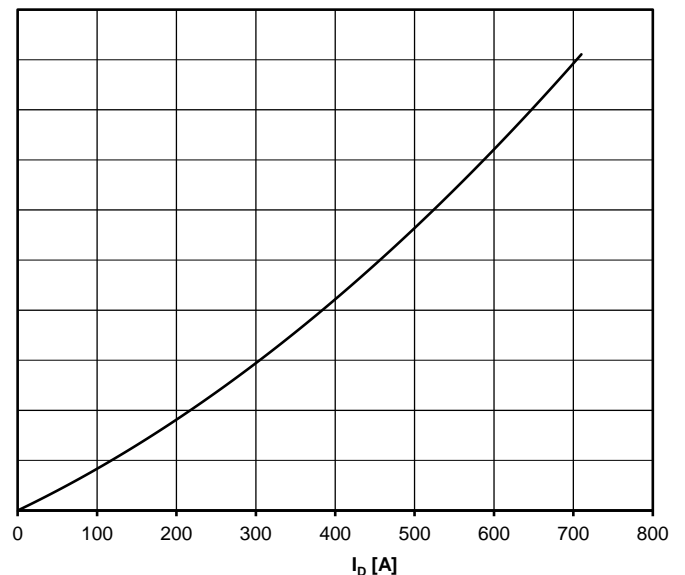
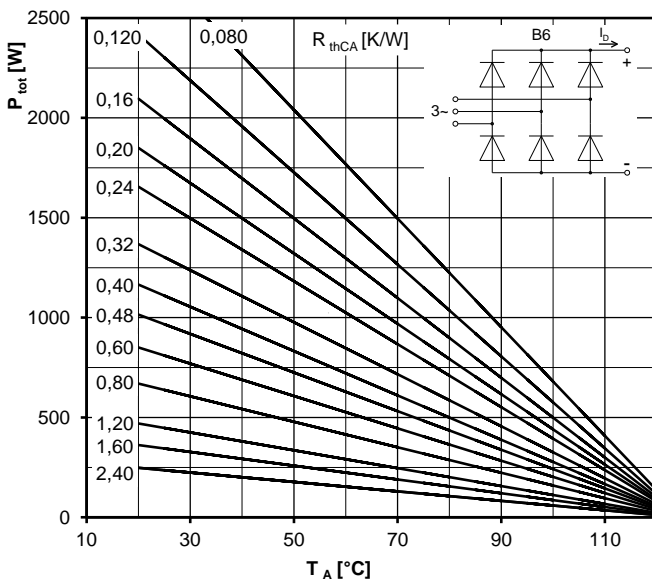
Höchstzulässiger Ausgangsstrom / Maximum rated output current I_D

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}



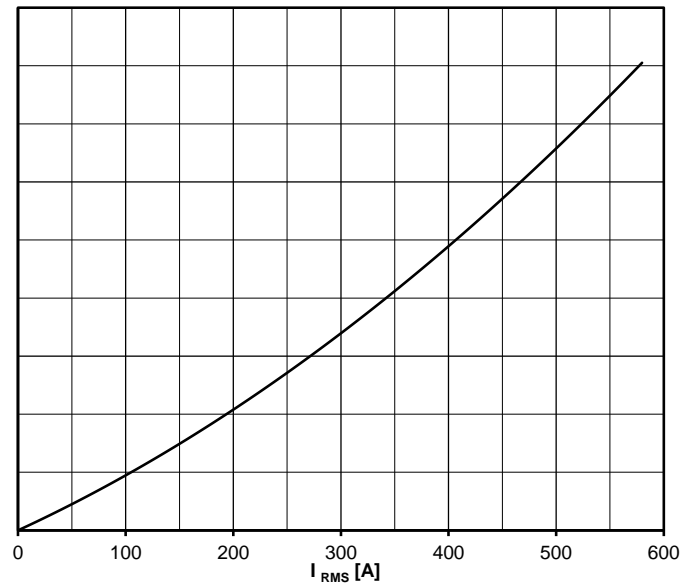
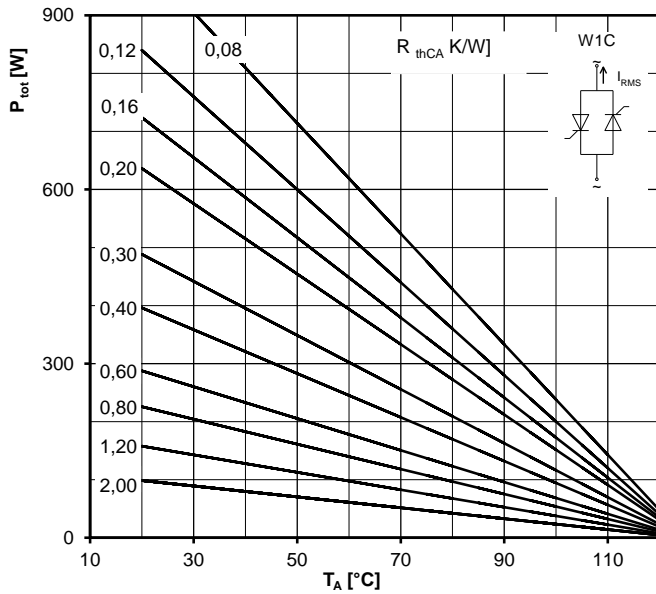
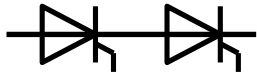
Höchstzulässiger Ausgangsstrom / Maximum rated output current I_D

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}



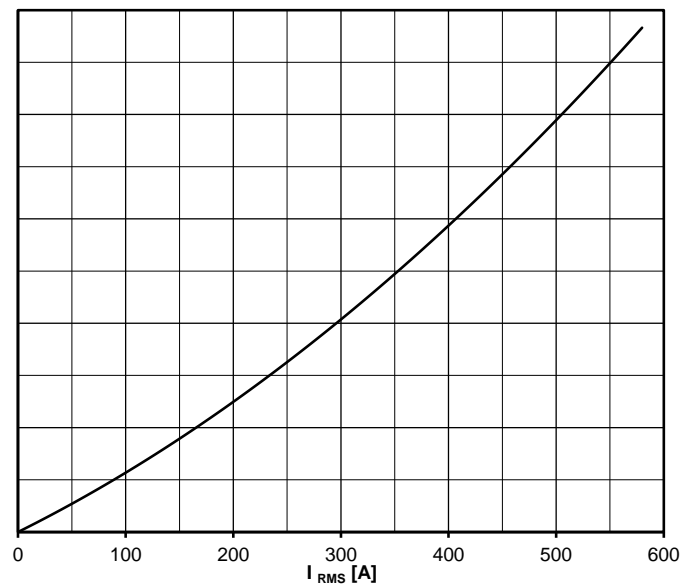
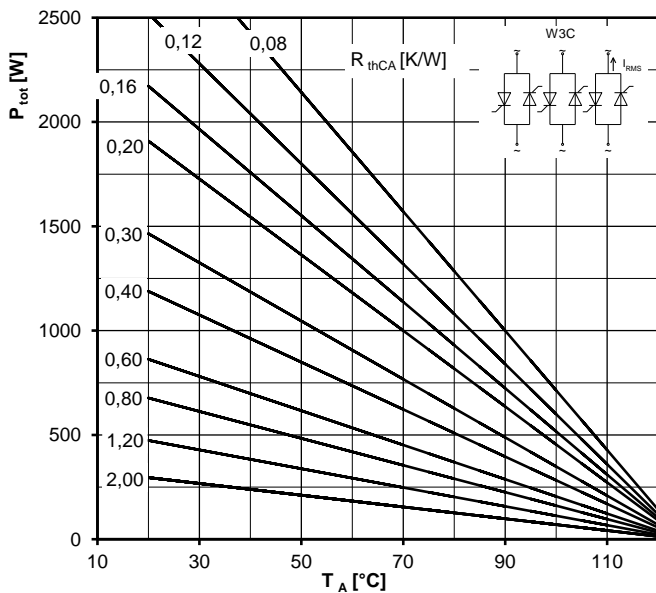
Höchstzulässiger Effektivstrom / Maximum rated RMS current I_{RMS}

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}



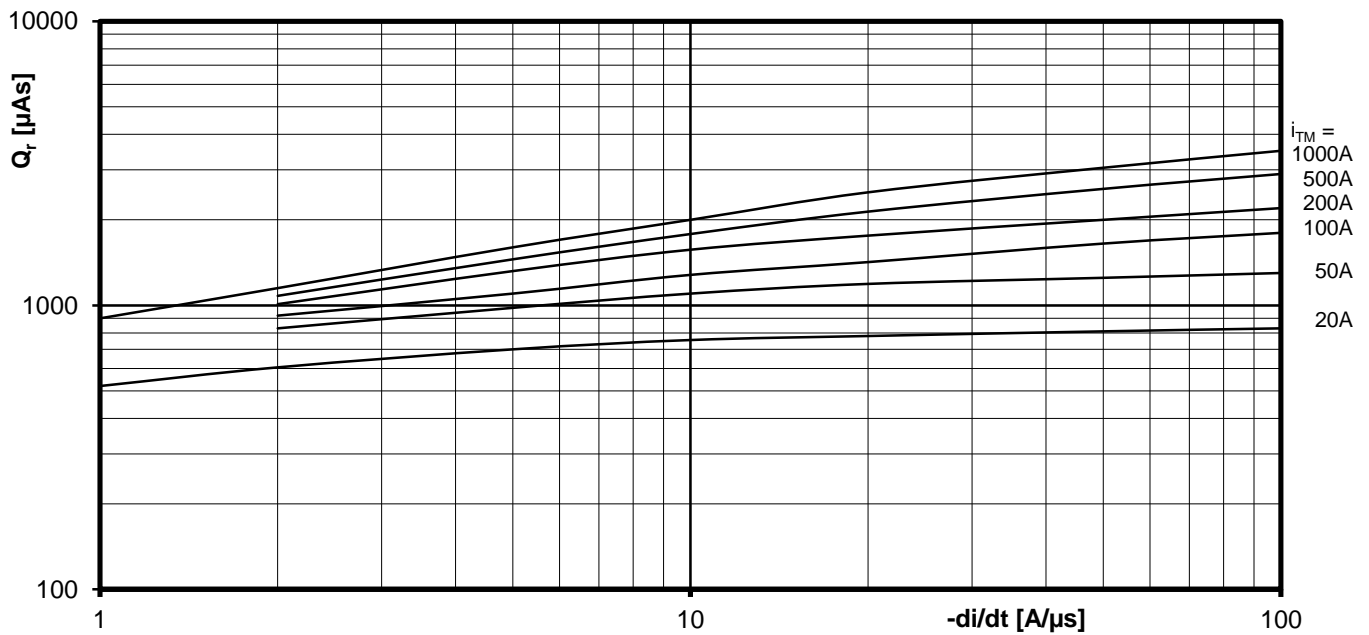
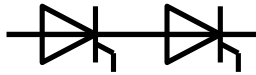
Höchstzulässiger Effektivstrom / Maximum rated RMS current I_{RMS}

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

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

Parameter:

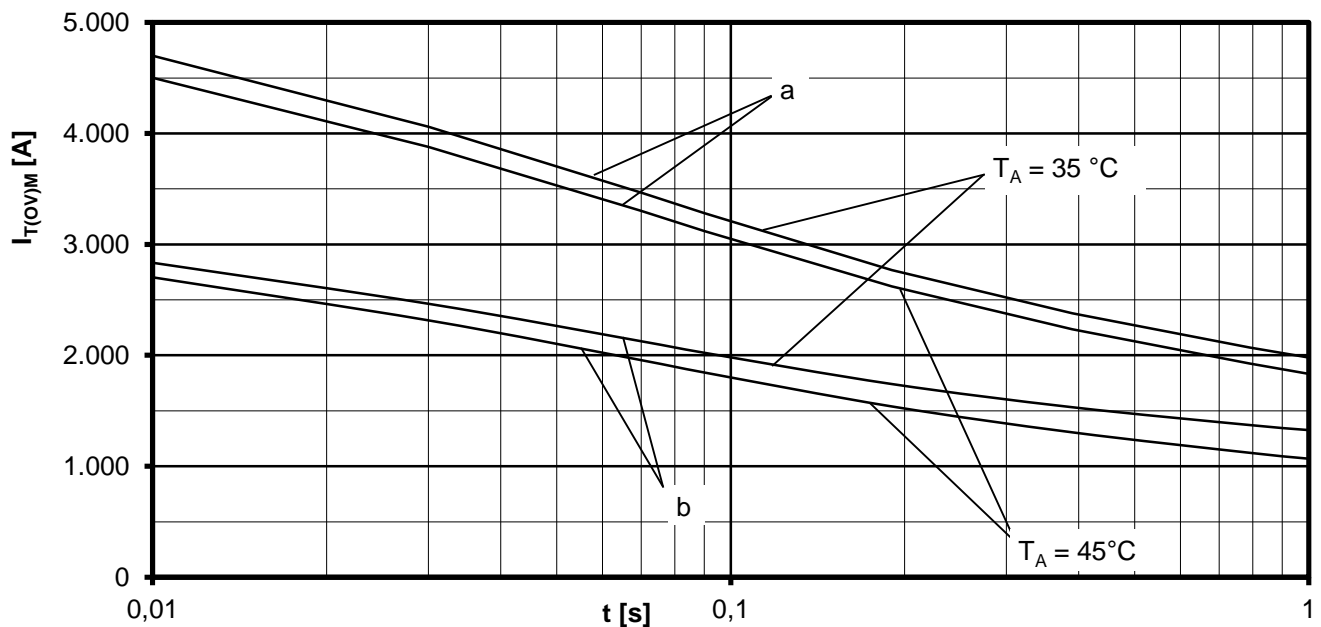
Wärmewiderstand pro Element zwischen den Gehäusen und Umgebung /
Thermal resistance per chip cases to ambient R_{thCA}



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