Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

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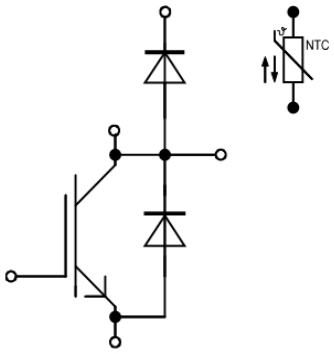
# Technische Information / Technical Information

IGBT-Module
IGBT-modules

# DF900R12IP4DV

PrimePACK™2 Modul mit Trench/Feldstopp IGBT4, größerer Emitter Controlled 4 Diode
PrimePACK™2 module with Trench/Fieldstop IGBT4, enlarged Emitter Controlled 4 diode

**Vorläufige Daten / Preliminary Data**




$V_{CES}$ = 1200V
$I_{C\ nom}$ = 900A / $I_{CRM}$ = 1800A

## Typische Anwendungen

- Hybrid-Nutzfahrzeuge

## Typical Applications

- Commercial Agriculture Vehicles

## Elektrische Eigenschaften

- Erweiterte Sperrschichttemperatur $T_{vj\ op}$
- Große DC-Festigkeit
- Hohe Kurzschlussrobustheit, selbstlimitierender Kurzschlussstrom
- Niedriges $V_{CEsat}$
- $V_{CEsat}$ mit positivem Temperaturkoeffizienten

## Electrical Features

- Extended Operation Temperature $T_{vj\ op}$
- High DC Stability
- High Short Circuit Capability, Self Limiting Short Circuit Current
- Low $V_{CEsat}$
- $V_{CEsat}$ with positive Temperature Coefficient

## Mechanische Eigenschaften

- 4 kV AC 1min Isolationsfestigkeit
- Gehäuse mit CTI > 400
- Große Luft- und Kriechstrecken
- Hohe Last- und thermische Wechselfestigkeit
- Hohe Leistungsdichte
- Substrat für kleinen thermischen Widerstand

## Mechanical Features

- 4 kV AC 1min Insulation
- Package with CTI > 400
- High Creepage and Clearance Distances
- High Power and Thermal Cycling Capability
- High Power Density
- Substrate for Low Thermal Resistance

## Module Label Code

**Barcode Code 128**

Sample
00000123456000000000000

**DMX - Code**

| Content of the Code | Digit |
|---|---|
| Module Serial Number | 1 - 5 |
| Module Material Number | 6 - 11 |
| Production Order Number | 12 - 19 |
| Datecode (Production Year) | 20 - 21 |
| Datecode (Production Week) | 22 - 23 |

| | | |
|---|---|---|
| prepared by: TA | date of publication: 2014-04-28 | |
| approved by: IB | revision: 2.0 | UL approved (E83335) |

**Vorläufige Daten**
**Preliminary Data**

## IGBT-Chopper / IGBT-Chopper

### Höchstzulässige Werte / Maximum Rated Values

| | | | | | |
|---|---|---|---|---|---|
| Kollektor-Emitter-Sperrspannung<br>Collector-emitter voltage | $T_{vj}$ = 25°C | $V_{CES}$ | | 1200 | V |
| Kollektor-Dauergleichstrom<br>Continuous DC collector current | $T_C$ = 100°C, $T_{vj\,max}$ = 175°C | $I_{C\,nom}$ | | 900 | A |
| Periodischer Kollektor-Spitzenstrom<br>Repetitive peak collector current | $t_P$ = 1 ms | $I_{CRM}$ | | 1800 | A |
| Gesamt-Verlustleistung<br>Total power dissipation | $T_C$ = 25°C, $T_{vj\,max}$ = 175°C | $P_{tot}$ | | 5,10 | kW |
| Gate-Emitter-Spitzenspannung<br>Gate-emitter peak voltage | | $V_{GES}$ | | +/-20 | V |

### Charakteristische Werte / Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Kollektor-Emitter-Sättigungsspannung<br>Collector-emitter saturation voltage | $I_C$ = 900 A, $V_{GE}$ = 15 V<br>$I_C$ = 900 A, $V_{GE}$ = 15 V<br>$I_C$ = 900 A, $V_{GE}$ = 15 V | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $V_{CE\,sat}$ | | 1,70<br>2,00<br>2,10 | 2,05 | V<br>V<br>V |
| Gate-Schwellenspannung<br>Gate threshold voltage | $I_C$ = 33,0 mA, $V_{CE}$ = $V_{GE}$, $T_{vj}$ = 25°C | | $V_{GEth}$ | 5,0 | 5,8 | 6,5 | V |
| Gateladung<br>Gate charge | $V_{GE}$ = -15 V ... +15 V | | $Q_G$ | | 6,40 | | µC |
| Interner Gatewiderstand<br>Internal gate resistor | $T_{vj}$ = 25°C | | $R_{Gint}$ | | 1,2 | | Ω |
| Eingangskapazität<br>Input capacitance | f = 1 MHz, $T_{vj}$ = 25°C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | | $C_{ies}$ | | 54,0 | | nF |
| Rückwirkungskapazität<br>Reverse transfer capacitance | f = 1 MHz, $T_{vj}$ = 25°C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | | $C_{res}$ | | 2,80 | | nF |
| Kollektor-Emitter-Reststrom<br>Collector-emitter cut-off current | $V_{CE}$ = 1200 V, $V_{GE}$ = 0 V, $T_{vj}$ = 25°C | | $I_{CES}$ | | | 5,0 | mA |
| Gate-Emitter-Reststrom<br>Gate-emitter leakage current | $V_{CE}$ = 0 V, $V_{GE}$ = 20 V, $T_{vj}$ = 25°C | | $I_{GES}$ | | | 400 | nA |
| Einschaltverzögerungszeit, induktive Last<br>Turn-on delay time, inductive load | $I_C$ = 900 A, $V_{CE}$ = 600 V<br>$V_{GE}$ = ±15 V<br>$R_{Gon}$ = 1,6 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d\,on}$ | | 0,20<br>0,22<br>0,22 | | µs<br>µs<br>µs |
| Anstiegszeit, induktive Last<br>Rise time, inductive load | $I_C$ = 900 A, $V_{CE}$ = 600 V<br>$V_{GE}$ = ±15 V<br>$R_{Gon}$ = 1,6 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_r$ | | 0,14<br>0,15<br>0,15 | | µs<br>µs<br>µs |
| Abschaltverzögerungszeit, induktive Last<br>Turn-off delay time, inductive load | $I_C$ = 900 A, $V_{CE}$ = 600 V<br>$V_{GE}$ = ±15 V<br>$R_{Goff}$ = 1,6 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d\,off}$ | | 0,70<br>0,80<br>0,85 | | µs<br>µs<br>µs |
| Fallzeit, induktive Last<br>Fall time, inductive load | $I_C$ = 900 A, $V_{CE}$ = 600 V<br>$V_{GE}$ = ±15 V<br>$R_{Goff}$ = 1,6 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_f$ | | 0,20<br>0,40<br>0,45 | | µs<br>µs<br>µs |
| Einschaltverlustenergie pro Puls<br>Turn-on energy loss per pulse | $I_C$ = 900 A, $V_{CE}$ = 600 V, $L_S$ = 45 nH<br>$V_{GE}$ = ±15 V, di/dt = 4800 A/µs ($T_{vj}$ = 150°C)<br>$R_{Gon}$ = 1,6 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{on}$ | | 50,0<br>70,0<br>80,0 | | mJ<br>mJ<br>mJ |
| Abschaltverlustenergie pro Puls<br>Turn-off energy loss per pulse | $I_C$ = 900 A, $V_{CE}$ = 600 V, $L_S$ = 45 nH<br>$V_{GE}$ = ±15 V, du/dt = 2700 V/µs ($T_{vj}$ = 150°C)<br>$R_{Goff}$ = 1,6 Ω | $T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{off}$ | | 150<br>200<br>205 | | mJ<br>mJ<br>mJ |
| Kurzschlußverhalten<br>SC data | $V_{GE} \leq$ 15 V, $V_{CC}$ = 800 V<br>$V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ | $t_P \leq$ 10 µs, $T_{vj}$ = 150°C | $I_{SC}$ | | 3600 | | A |
| Wärmewiderstand, Chip bis Gehäuse<br>Thermal resistance, junction to case | pro IGBT / per IGBT | | $R_{thJC}$ | | | 29,5 | K/kW |
| Wärmewiderstand, Gehäuse bis Kühlkörper<br>Thermal resistance, case to heatsink | pro IGBT / per IGBT<br>$\lambda_{Paste}$ = 1 W/(m·K) / $\lambda_{grease}$ = 1 W/(m·K) | | $R_{thCH}$ | | 16,0 | | K/kW |
| Temperatur im Schaltbetrieb<br>Temperature under switching conditions | | | $T_{vj\,op}$ | -40 | | 150 | °C |


| | |
|---|---|
| prepared by: TA | date of publication: 2014-04-28 |
| approved by: IB | revision: 2.0 |

**Vorläufige Daten**
**Preliminary Data**

## Diode-Chopper / Diode-Chopper

### Höchstzulässige Werte / Maximum Rated Values

| | | | | | |
|---|---|---|---|---|---|
| Periodische Spitzensperrspannung<br>Repetitive peak reverse voltage | $T_{vj}$ = 25°C | $V_{RRM}$ | 1200 | | V |
| Dauergleichstrom<br>Continuous DC forward current | | $I_F$ | 900 | | A |
| Periodischer Spitzenstrom<br>Repetitive peak forward current | $t_P$ = 1 ms | $I_{FRM}$ | 1800 | | A |
| Grenzlastintegral<br>I²t - value | $V_R$ = 0 V, $t_P$ = 10 ms, $T_{vj}$ = 125°C<br>$V_R$ = 0 V, $t_P$ = 10 ms, $T_{vj}$ = 150°C | I²t | 150<br>145 | | kA²s<br>kA²s |

### Charakteristische Werte / Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Durchlassspannung<br>Forward voltage | $I_F$ = 900 A, $V_{GE}$ = 0 V $T_{vj}$ = 25°C<br>$I_F$ = 900 A, $V_{GE}$ = 0 V $T_{vj}$ = 125°C<br>$I_F$ = 900 A, $V_{GE}$ = 0 V $T_{vj}$ = 150°C | $V_F$ | | 1,65<br>1,55<br>1,50 | 2,15 | V<br>V<br>V |
| Rückstromspitze<br>Peak reverse recovery current | $I_F$ = 900 A, - $di_F/dt$ = 4800 A/µs ($T_{vj}$=150°C) $T_{vj}$ = 25°C<br>$V_R$ = 600 V $T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $I_{RM}$ | | 560<br>770<br>820 | | A<br>A<br>A |
| Sperrverzögerungsladung<br>Recovered charge | $I_F$ = 900 A, - $di_F/dt$ = 4800 A/µs ($T_{vj}$=150°C) $T_{vj}$ = 25°C<br>$V_R$ = 600 V $T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $Q_r$ | | 110<br>200<br>225 | | µC<br>µC<br>µC |
| Abschaltenergie pro Puls<br>Reverse recovery energy | $I_F$ = 900 A, - $di_F/dt$ = 4800 A/µs ($T_{vj}$=150°C) $T_{vj}$ = 25°C<br>$V_R$ = 600 V $T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{rec}$ | | 50,0<br>90,0<br>105 | | mJ<br>mJ<br>mJ |
| Wärmewiderstand, Chip bis Gehäuse<br>Thermal resistance, junction to case | pro Diode / per diode | $R_{thJC}$ | | | 37,0 | K/kW |
| Wärmewiderstand, Gehäuse bis Kühlkörper<br>Thermal resistance, case to heatsink | pro Diode / per diode<br>$\lambda_{Paste}$ = 1 W/(m·K) / $\lambda_{grease}$ = 1 W/(m·K) | $R_{thCH}$ | | 20,0 | | K/kW |
| Temperatur im Schaltbetrieb<br>Temperature under switching conditions | | $T_{vj\,op}$ | -40 | | 150 | °C |

## Diode, Revers / Diode, Reverse

### Höchstzulässige Werte / Maximum Rated Values

| | | | | | |
|---|---|---|---|---|---|
| Periodische Spitzensperrspannung<br>Repetitive peak reverse voltage | $T_{vj}$ = 25°C | $V_{RRM}$ | 1200 | | V |
| Dauergleichstrom<br>Continuous DC forward current | | $I_F$ | 120 | | A |
| Periodischer Spitzenstrom<br>Repetitive peak forward current | $t_P$ = 1 ms | $I_{FRM}$ | 240 | | A |
| Grenzlastintegral<br>I²t - value | $V_R$ = 0 V, $t_P$ = 10 ms, $T_{vj}$ = 125°C | I²t | 0,17 | | kA²s |

### Charakteristische Werte / Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Durchlassspannung<br>Forward voltage | $I_F$ = 120 A, $V_{GE}$ = 0 V $T_{vj}$ = 25°C<br>$I_F$ = 120 A, $V_{GE}$ = 0 V $T_{vj}$ = 125°C | $V_F$ | | 1,65<br>1,65 | 2,15 | V<br>V |
| Wärmewiderstand, Chip bis Gehäuse<br>Thermal resistance, junction to case | pro Diode / per diode | $R_{thJC}$ | | | 340 | K/kW |
| Wärmewiderstand, Gehäuse bis Kühlkörper<br>Thermal resistance, case to heatsink | pro Diode / per diode<br>$\lambda_{Paste}$ = 1 W/(m·K) / $\lambda_{grease}$ = 1 W/(m·K) | $R_{thCH}$ | | 170 | | K/kW |
| Temperatur im Schaltbetrieb<br>Temperature under switching conditions | | $T_{vj\,op}$ | -40 | | 150 | °C |

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**Vorläufige Daten**
**Preliminary Data**

## NTC-Widerstand / NTC-Thermistor

### Charakteristische Werte / Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Nennwiderstand<br>Rated resistance | $T_C$ = 25°C | $R_{25}$ | | 5,00 | | kΩ |
| Abweichung von R100<br>Deviation of R100 | $T_C$ = 100°C, $R_{100}$ = 493 Ω | ΔR/R | -5 | | 5 | % |
| Verlustleistung<br>Power dissipation | $T_C$ = 25°C | $P_{25}$ | | | 20,0 | mW |
| B-Wert<br>B-value | $R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15\ K))]$ | $B_{25/50}$ | | 3375 | | K |
| B-Wert<br>B-value | $R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15\ K))]$ | $B_{25/80}$ | | 3411 | | K |
| B-Wert<br>B-value | $R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15\ K))]$ | $B_{25/100}$ | | 3433 | | K |

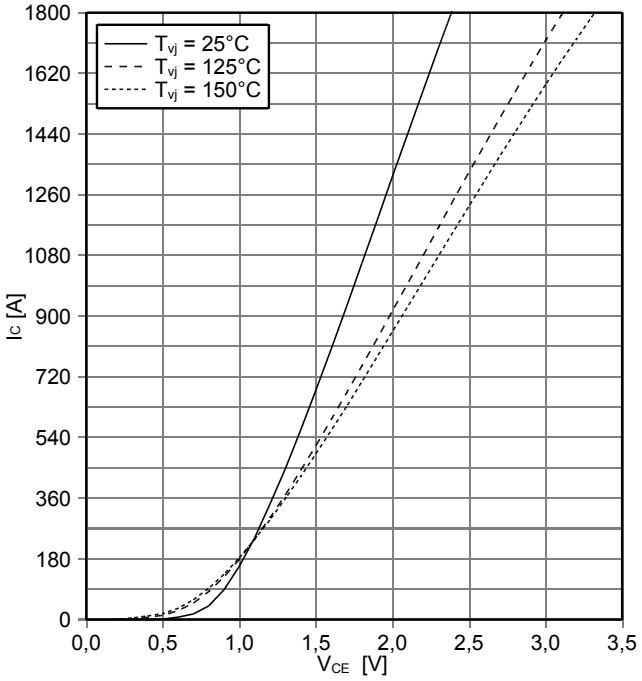
Angaben gemäß gültiger Application Note.
Specification according to the valid application note.

## Modul / Module

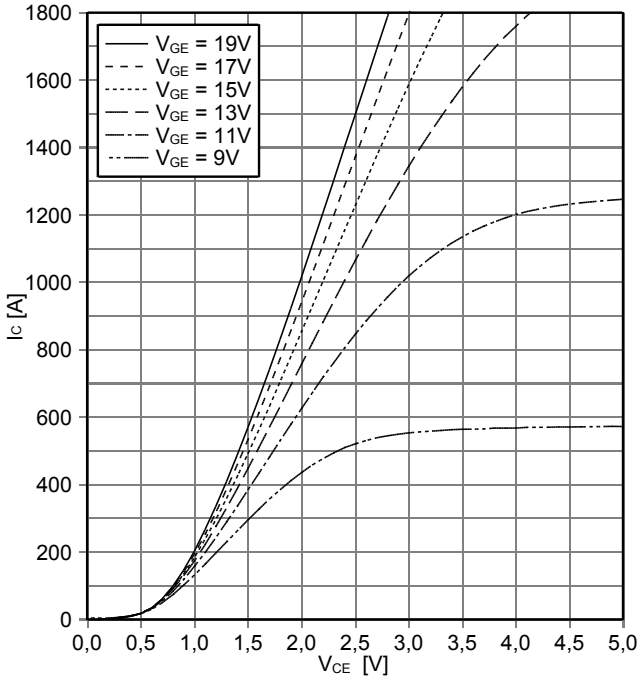
| | | | | | | |
|---|---|---|---|---|---|---|
| Isolations-Prüfspannung<br>Isolation test voltage | RMS, f = 50 Hz, t = 1 min. | $V_{ISOL}$ | | 4,0 | | kV |
| Material Modulgrundplatte<br>Material of module baseplate | | | | Cu | | |
| Innere Isolation<br>Internal isolation | Basisisolierung (Schutzklasse 1, EN61140)<br>basic insulation (class 1, IEC 61140) | | | $Al_2O_3$ | | |
| Kriechstrecke<br>Creepage distance | Kontakt - Kühlkörper / terminal to heatsink<br>Kontakt - Kontakt / terminal to terminal | | | 33,0<br>33,0 | | mm |
| Luftstrecke<br>Clearance | Kontakt - Kühlkörper / terminal to heatsink<br>Kontakt - Kontakt / terminal to terminal | | | 19,0<br>19,0 | | mm |
| Vergleichszahl der Kriechwegbildung<br>Comperative tracking index | | CTI | | > 400 | | |
| | | | min. | typ. | max. | |
| Modulstreuinduktivität<br>Stray inductance module | | $L_{sCE}$ | | 18 | | nH |
| Modulleitungswiderstand, Anschlüsse - Chip<br>Module lead resistance, terminals - chip | $T_C$ = 25°C, pro Schalter / per switch | $R_{CC'+EE'}$ | | 0,30 | | mΩ |
| Lagertemperatur<br>Storage temperature | | $T_{stg}$ | -40 | | 150 | °C |
| Anzugsdrehmoment f. Modulmontage<br>Mounting torque for modul mounting | Schraube M5 - Montage gem. gültiger Applikationsschrift<br>Screw M5 - Mounting according to valid application note | M | 3,00 | - | 6,00 | Nm |
| Anzugsdrehmoment f. elektr. Anschlüsse<br>Terminal connection torque | Schraube M4 - Montage gem. gültiger Applikationsschrift<br>Screw M4 - Mounting according to valid application note<br>Schraube M8 - Montage gem. gültiger Applikationsschrift<br>Screw M8 - Mounting according to valid application note | M | 1,8<br><br>8,0 | -<br><br>- | 2,1<br><br>10 | Nm<br><br>Nm |
| Gewicht<br>Weight | | G | | 825 | | g |

**Vorläufige Daten**
**Preliminary Data**

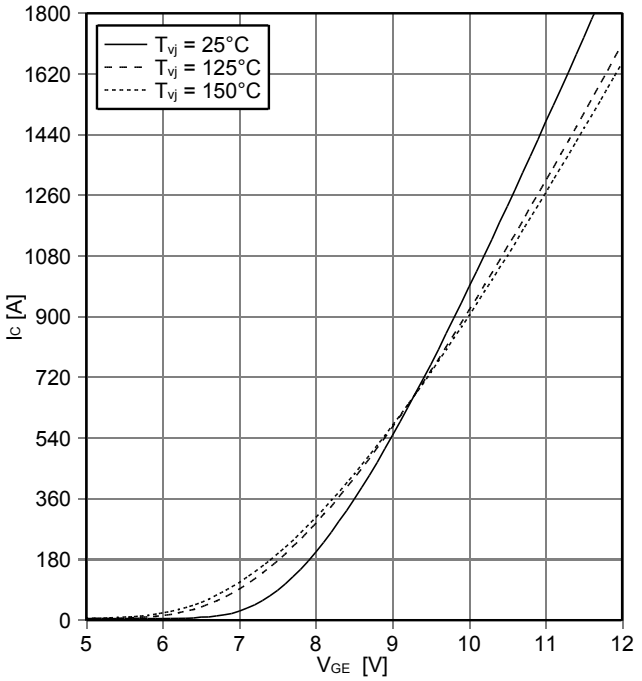
**Ausgangskennlinie IGBT-Chopper (typisch)**
**output characteristic IGBT-Chopper (typical)**
$I_C = f(V_{CE})$
$V_{GE}$ = 15 V



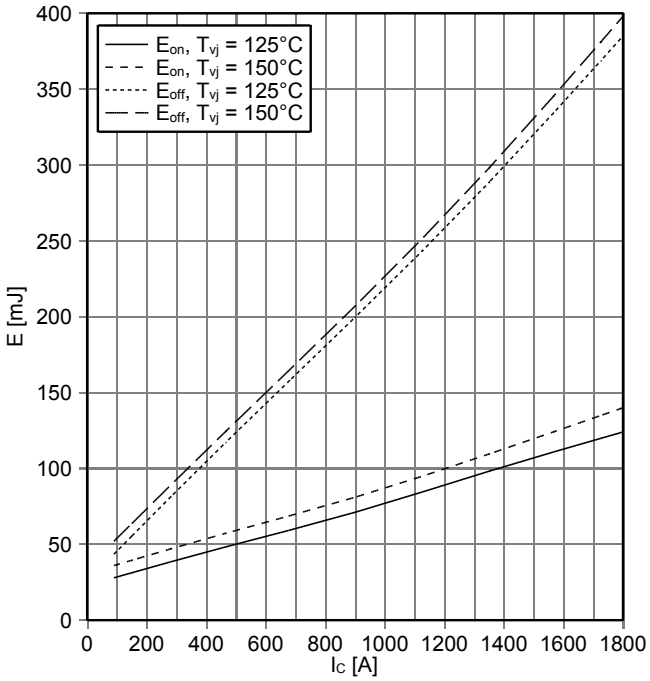

**Ausgangskennlinienfeld IGBT-Chopper (typisch)**
**output characteristic IGBT-Chopper (typical)**
$I_C = f(V_{CE})$
$T_{vj}$ = 150°C




**Übertragungscharakteristik IGBT-Chopper (typisch)**
**transfer characteristic IGBT-Chopper (typical)**
$I_C = f(V_{GE})$
$V_{CE}$ = 20 V




**Schaltverluste IGBT-Chopper (typisch)**
**switching losses IGBT-Chopper (typical)**
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE}$ = ±15 V, $R_{Gon}$ = 1.6 Ω, $R_{Goff}$ = 1.6 Ω, $V_{CE}$ = 600 V

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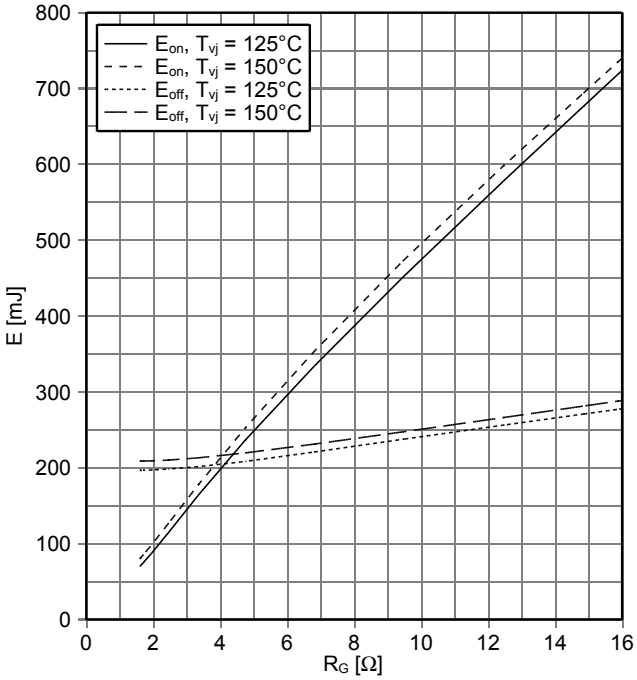
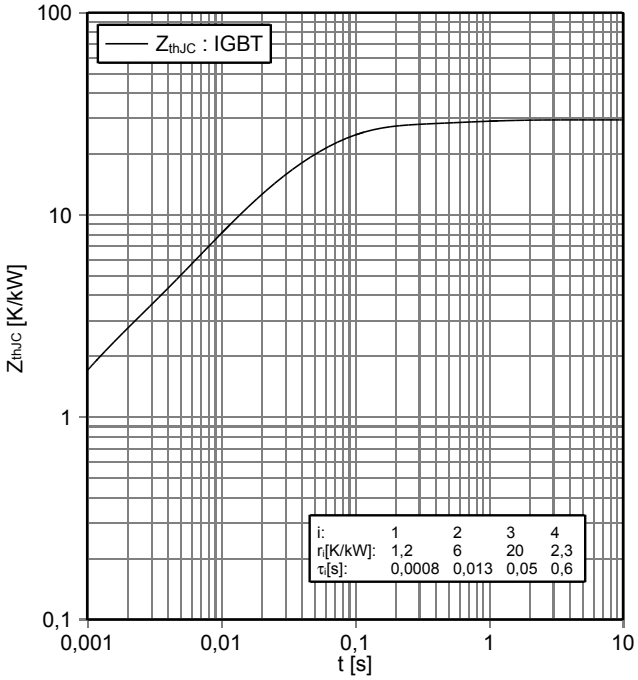
|---|---|
| prepared by: TA | date of publication: 2014-04-28 |
| approved by: IB | revision: 2.0 |

**Vorläufige Daten**
**Preliminary Data**

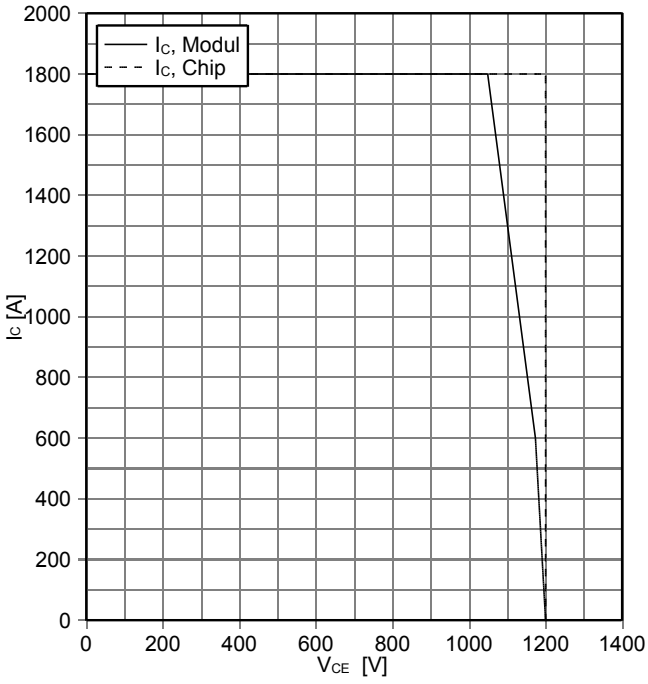
**Schaltverluste IGBT-Chopper (typisch)**
**switching losses IGBT-Chopper (typical)**
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
$V_{GE}$ = ±15 V, $I_C$ = 900 A, $V_{CE}$ = 600 V



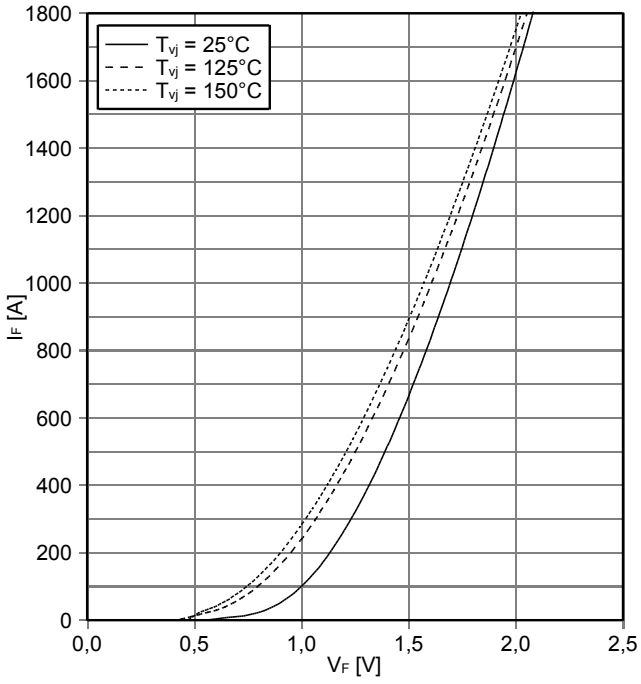

**Transienter Wärmewiderstand IGBT-Chopper**
**transient thermal impedance IGBT-Chopper**
$Z_{thJC} = f(t)$




**Sicherer Rückwärts-Arbeitsbereich IGBT-Chopper (RBSOA)**
**reverse bias safe operating area IGBT-Chopper (RBSOA)**
$I_C = f(V_{CE})$
$V_{GE}$ = ±15 V, $R_{Goff}$ = 1.6 Ω, $T_{vj}$ = 150°C




**Durchlasskennlinie der Diode-Chopper (typisch)**
**forward characteristic of Diode-Chopper (typical)**
$I_F = f(V_F)$

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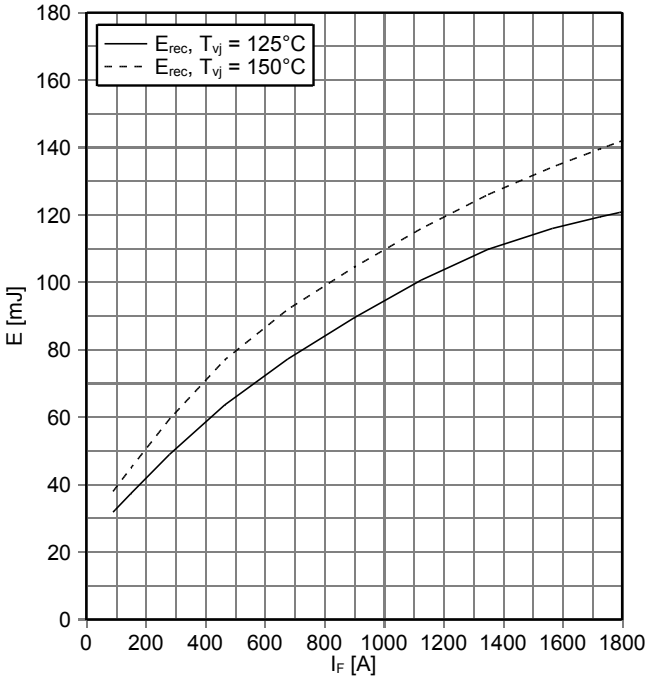
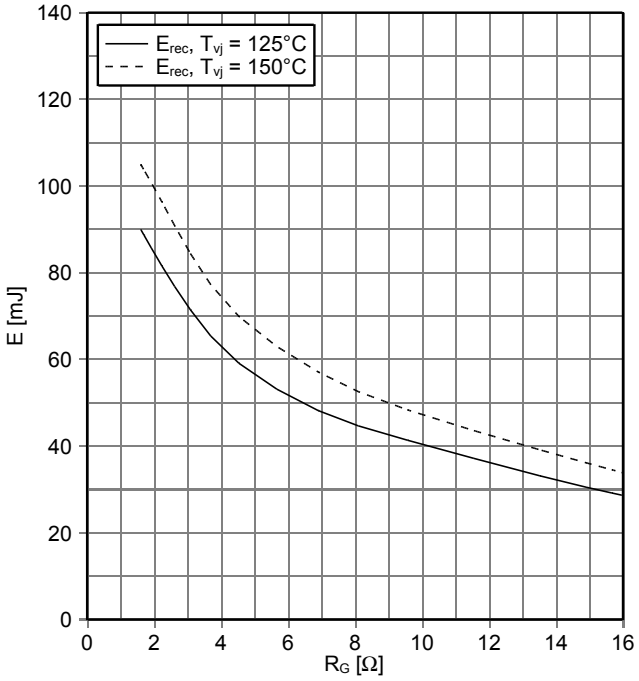
|---|---|
| prepared by: TA | date of publication: 2014-04-28 |
| approved by: IB | revision: 2.0 |

**Vorläufige Daten**
**Preliminary Data**

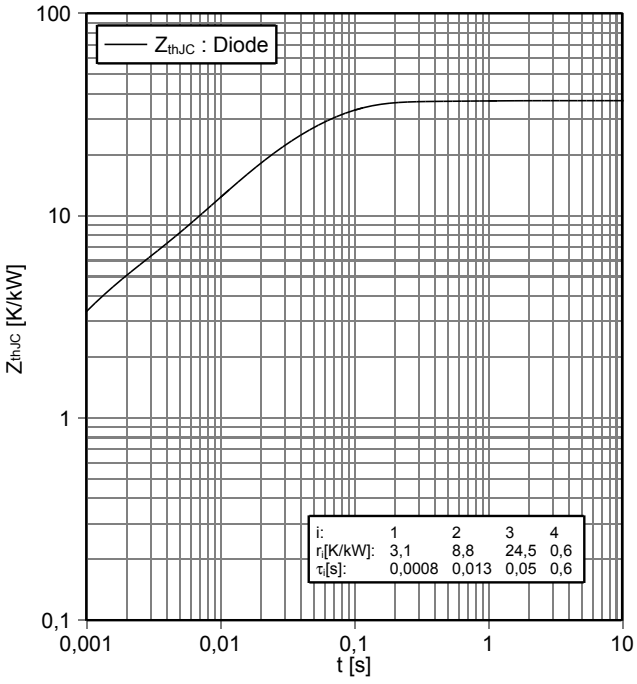
**Schaltverluste Diode-Chopper (typisch)**
**switching losses Diode-Chopper (typical)**
$E_{rec} = f(I_F)$
$R_{Gon} = 1.6\ \Omega$, $V_{CE} = 600$ V



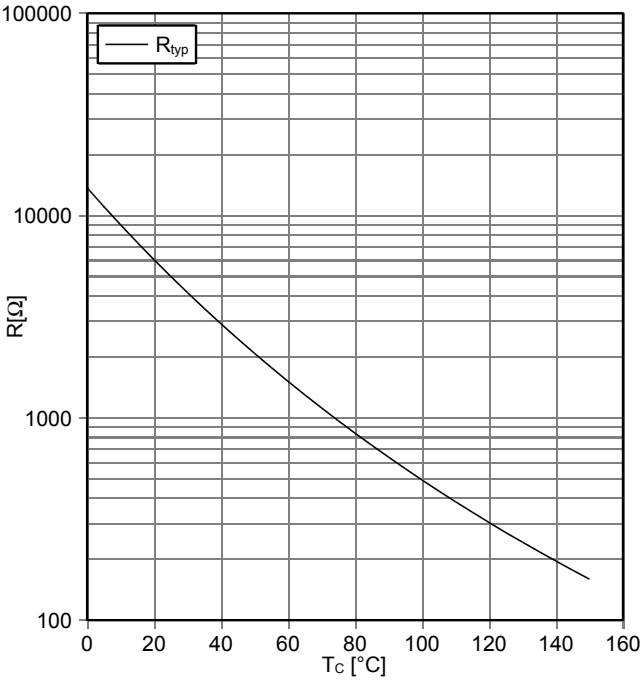

**Schaltverluste Diode-Chopper (typisch)**
**switching losses Diode-Chopper (typical)**
$E_{rec} = f(R_G)$
$I_F = 900$ A, $V_{CE} = 600$ V




**Transienter Wärmewiderstand Diode-Chopper**
**transient thermal impedance Diode-Chopper**
$Z_{thJC} = f(t)$




**NTC-Widerstand-Temperaturkennlinie (typisch)**
**NTC-Thermistor-temperature characteristic (typical)**
$R = f(T)$

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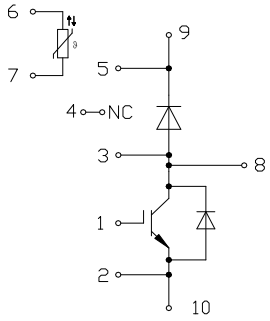
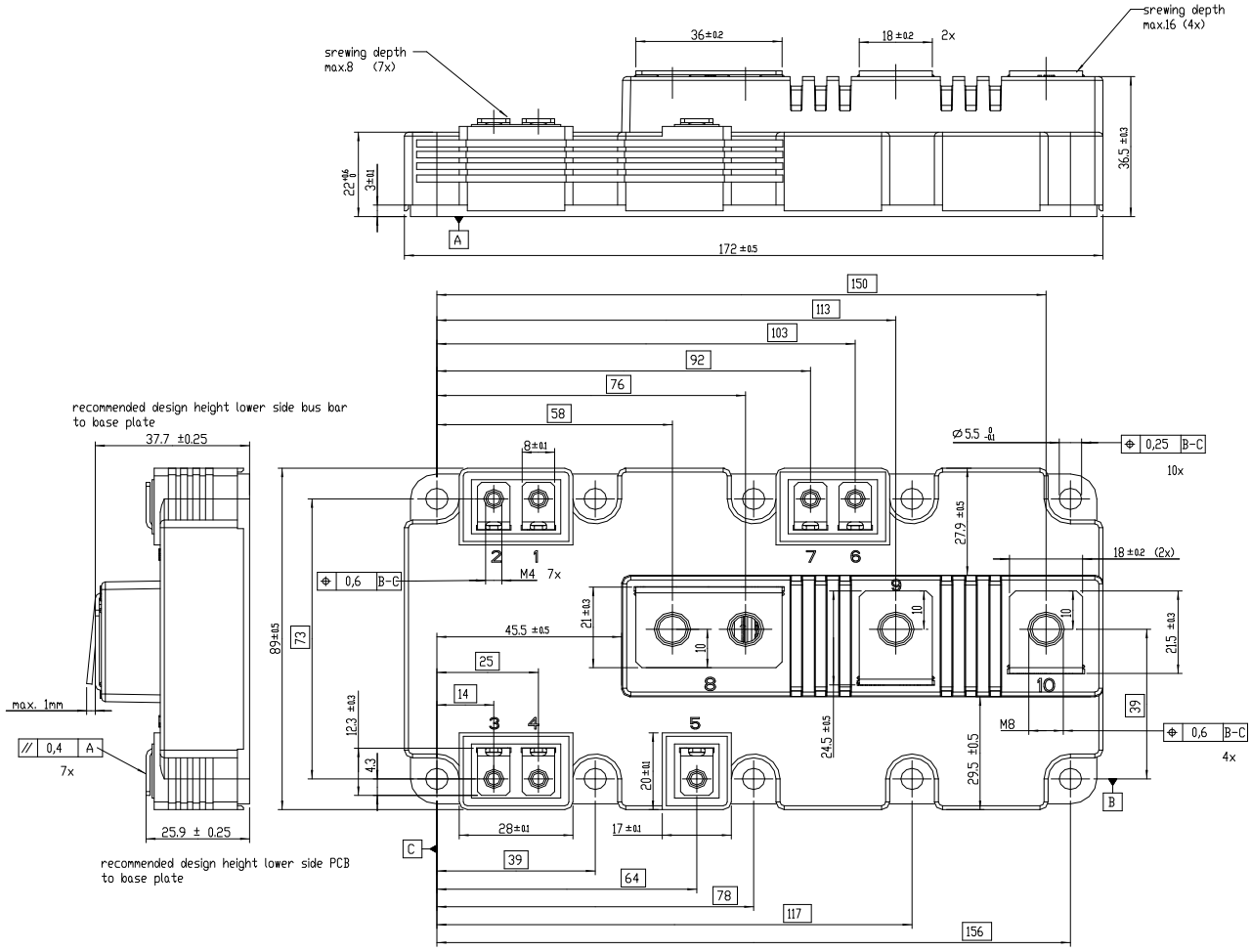
**Vorläufige Daten**
**Preliminary Data**

## Schaltplan / circuit_diagram_headline




## Gehäuseabmessungen / package outlines

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**Vorläufige Daten**
**Preliminary Data**

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