

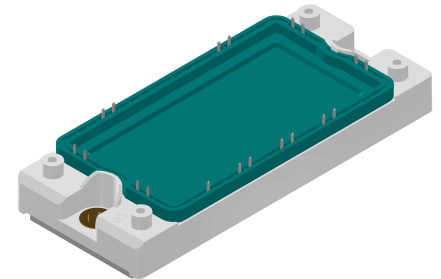
Standard Rectifier Module

| 3~ Rectifier | Brake Chopper |
|----------------------------|-------------------------------|
| $V_{RRM} = 1600 \text{ V}$ | $V_{CES} = 1200 \text{ V}$ |
| $I_{DAV} = 120 \text{ A}$ | $I_{C25} = 120 \text{ A}$ |
| $I_{FSM} = 700 \text{ A}$ | $V_{CE(sat)} = 1.8 \text{ V}$ |

3~ Rectifier Bridge + Brake Unit + NTC

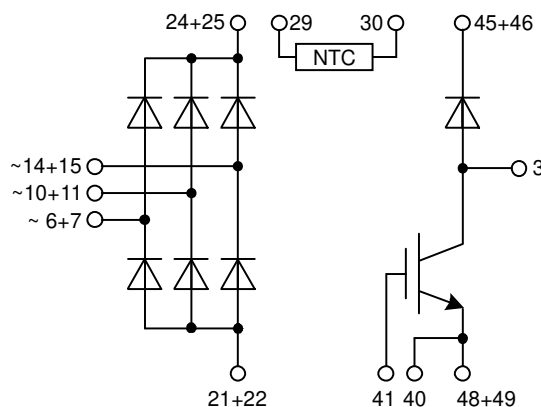
Part number

VUB116-16NOXT



Backside: isolated

 E72873



Features / Advantages:

- Package with DCB ceramic
- Improved temperature and power cycling
- Planar passivated chips
- Very low forward voltage drop
- Very low leakage current
- NTC

Applications:

- 3~ Rectifier with brake unit for drive inverters

Package: E2-Pack

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Height: 17 mm
- Base plate: Copper internally DCB isolated
- Advanced power cycling
- Phase Change Material available

Disclaimer Notice

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| Rectifier | | | | Ratings | | | |
|------------|--|-----------------------------------|-------------|------------------------------|------|------|-------------------|
| Symbol | Definition | Conditions | | min. | typ. | max. | Unit |
| V_{RSM} | max. non-repetitive reverse blocking voltage | | | | | 1700 | V |
| V_{RRM} | max. repetitive reverse blocking voltage | | | | | 1600 | V |
| I_R | reverse current | $V_R = 1600$ V | | $T_{VJ} = 25^\circ\text{C}$ | | 100 | μA |
| | | $V_R = 1600$ V | | $T_{VJ} = 150^\circ\text{C}$ | | 1.5 | mA |
| V_F | forward voltage drop | $I_F = 40$ A | | $T_{VJ} = 25^\circ\text{C}$ | | 1.19 | V |
| | | $I_F = 120$ A | | | | 1.64 | V |
| | | $I_F = 40$ A | | $T_{VJ} = 125^\circ\text{C}$ | | 1.12 | V |
| | | $I_F = 120$ A | | | | 1.70 | V |
| I_{DAV} | bridge output current | $T_C = 105^\circ\text{C}$ | rectangular | $T_{VJ} = 150^\circ\text{C}$ | | 120 | A |
| V_{FO} | threshold voltage | } for power loss calculation only | | $T_{VJ} = 150^\circ\text{C}$ | | 0.80 | V |
| r_F | slope resistance | | | | | 7.6 | m Ω |
| R_{thJC} | thermal resistance junction to case | | | | | 0.65 | K/W |
| R_{thCH} | thermal resistance case to heatsink | | | | 0.1 | | K/W |
| P_{tot} | total power dissipation | | | $T_C = 25^\circ\text{C}$ | | 190 | W |
| I_{FSM} | max. forward surge current | $t = 10$ ms; (50 Hz), sine | | $T_{VJ} = 45^\circ\text{C}$ | | 700 | A |
| | | $t = 8,3$ ms; (60 Hz), sine | | $V_R = 0$ V | | 755 | A |
| | | $t = 10$ ms; (50 Hz), sine | | $T_{VJ} = 150^\circ\text{C}$ | | 595 | A |
| | | $t = 8,3$ ms; (60 Hz), sine | | $V_R = 0$ V | | 645 | A |
| I^2t | value for fusing | $t = 10$ ms; (50 Hz), sine | | $T_{VJ} = 45^\circ\text{C}$ | | 2.45 | kA ² s |
| | | $t = 8,3$ ms; (60 Hz), sine | | $V_R = 0$ V | | 2.37 | kA ² s |
| | | $t = 10$ ms; (50 Hz), sine | | $T_{VJ} = 150^\circ\text{C}$ | | 1.77 | kA ² s |
| | | $t = 8,3$ ms; (60 Hz), sine | | $V_R = 0$ V | | 1.73 | kA ² s |
| C_J | junction capacitance | $V_R = 400$ V; $f = 1$ MHz | | $T_{VJ} = 25^\circ\text{C}$ | | 27 | pF |



| Brake IGBT | | | | Ratings | | | |
|--------------------|--------------------------------------|--|------|---------|------|------|--|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit | |
| V_{CES} | collector emitter voltage | | | | 1200 | V | |
| V_{GES} | max. DC gate voltage | | | | ±20 | V | |
| V_{GEM} | max. transient gate emitter voltage | | | | ±30 | V | |
| I_{C25} | collector current | | | | 120 | A | |
| I_{C80} | | | | | 84 | A | |
| P_{tot} | total power dissipation | | | | 390 | W | |
| $V_{CE(sat)}$ | collector emitter saturation voltage | $I_C = 75 \text{ A}; V_{GE} = 15 \text{ V}$ | | | 1.8 | V | |
| | | | | | 2.1 | V | |
| $V_{GE(th)}$ | gate emitter threshold voltage | $I_C = 3 \text{ mA}; V_{GE} = V_{CE}$ | 5.5 | 6.0 | 6.5 | V | |
| I_{CES} | collector emitter leakage current | $V_{CE} = V_{CES}; V_{GE} = 0 \text{ V}$ | | | 0.2 | mA | |
| | | | | | 0.6 | mA | |
| I_{GES} | gate emitter leakage current | $V_{GE} = \pm 20 \text{ V}$ | | | 500 | nA | |
| $Q_{G(on)}$ | total gate charge | $V_{CE} = 600 \text{ V}; V_{GE} = 15 \text{ V}; I_C = 75 \text{ A}$ | | 230 | | nC | |
| $t_{d(on)}$ | turn-on delay time | inductive load $V_{CE} = 600 \text{ V}; I_C = 75 \text{ A}$ $V_{GE} = \pm 15 \text{ V}; R_G = 10 \Omega$ | | 70 | | ns | |
| t_r | current rise time | | | 40 | | ns | |
| $t_{d(off)}$ | turn-off delay time | | | 250 | | ns | |
| t_f | current fall time | | | 100 | | ns | |
| E_{on} | turn-on energy per pulse | | | 6.8 | | mJ | |
| E_{off} | turn-off energy per pulse | | | 8.3 | | mJ | |
| RBSOA | reverse bias safe operating area | $V_{GE} = \pm 15 \text{ V}; R_G = 10 \Omega$ | | | | | |
| I_{CM} | | $V_{CEK} = 1200 \text{ V}$ | | | 225 | A | |
| SCSOA | short circuit safe operating area | $V_{CEK} = 1200 \text{ V}$ | | | | | |
| t_{SC} | short circuit duration | $V_{CE} = 900 \text{ V}; V_{GE} = \pm 15$ | | | 10 | µs | |
| I_{SC} | short circuit current | $R_G = 10 \Omega$; non-repetitive | | 300 | | A | |
| R_{thJC} | thermal resistance junction to case | | | | 0.32 | K/W | |
| R_{thCH} | thermal resistance case to heatsink | | | | 0.15 | K/W | |
| Brake Diode | | | | | | | |
| V_{RRM} | max. repetitive reverse voltage | | | | 1200 | V | |
| I_{F25} | forward current | | | | 48 | A | |
| I_{F80} | | | | | 32 | A | |
| V_F | forward voltage | $I_F = 30 \text{ A}$ | | | 2.75 | V | |
| | | | | | 1.99 | V | |
| I_R | reverse current | $V_R = V_{RRM}$ | | | 0.25 | mA | |
| | | | | | 1 | mA | |
| Q_{rr} | reverse recovery charge | $V_R = 600 \text{ V}$ $-di_f/dt = 400 \text{ A}/\mu\text{s}$ $I_F = 30 \text{ A}; V_{GE} = 0 \text{ V}$ | | 1.8 | | µC | |
| I_{RM} | max. reverse recovery current | | | 23 | | A | |
| t_{rr} | reverse recovery time | | | 150 | | ns | |
| R_{thJC} | thermal resistance junction to case | | | | 0.9 | K/W | |
| R_{thCH} | thermal resistance case to heatsink | | | | 0.3 | K/W | |

| Package E2-Pack | | Ratings | | | | |
|-----------------|--|---|------|------|------|------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| I_{RMS} | RMS current | per terminal | | | 50 | A |
| T_{VJ} | virtual junction temperature | | -40 | | 150 | °C |
| T_{op} | operation temperature | | -40 | | 125 | °C |
| T_{stg} | storage temperature | | -40 | | 125 | °C |
| Weight | | | | 176 | | g |
| M_D | mounting torque | | 3 | | 6 | Nm |
| $d_{Spp/App}$ | creepage distance on surface / striking distance through air | terminal to terminal | 6.0 | | | mm |
| $d_{Spb/Apb}$ | | terminal to backside | 12.0 | | | mm |
| V_{ISOL} | isolation voltage | t = 1 second 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA | 3600 | | | V |
| | | t = 1 minute | 3000 | | | V |



| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | VUB116-16NOXT | VUB116-16NOXT | Box | 6 | 510755 |

Temperature Sensor NTC

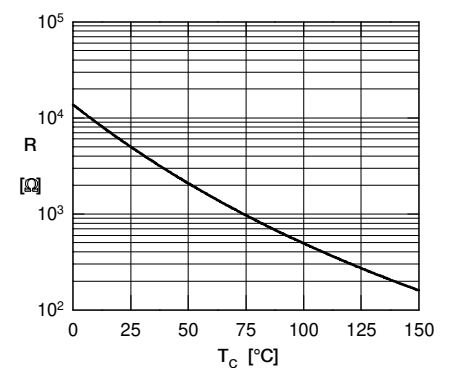
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
|-------------|-------------------------|---------------------|------|------|------|------------|
| R_{25} | resistance | $T_{VJ} = 25^\circ$ | 4.75 | 5 | 5.25 | k Ω |
| $B_{25/50}$ | temperature coefficient | | | 3375 | | K |

Equivalent Circuits for Simulation

* on die level

$T_{VJ} = 150^\circ\text{C}$

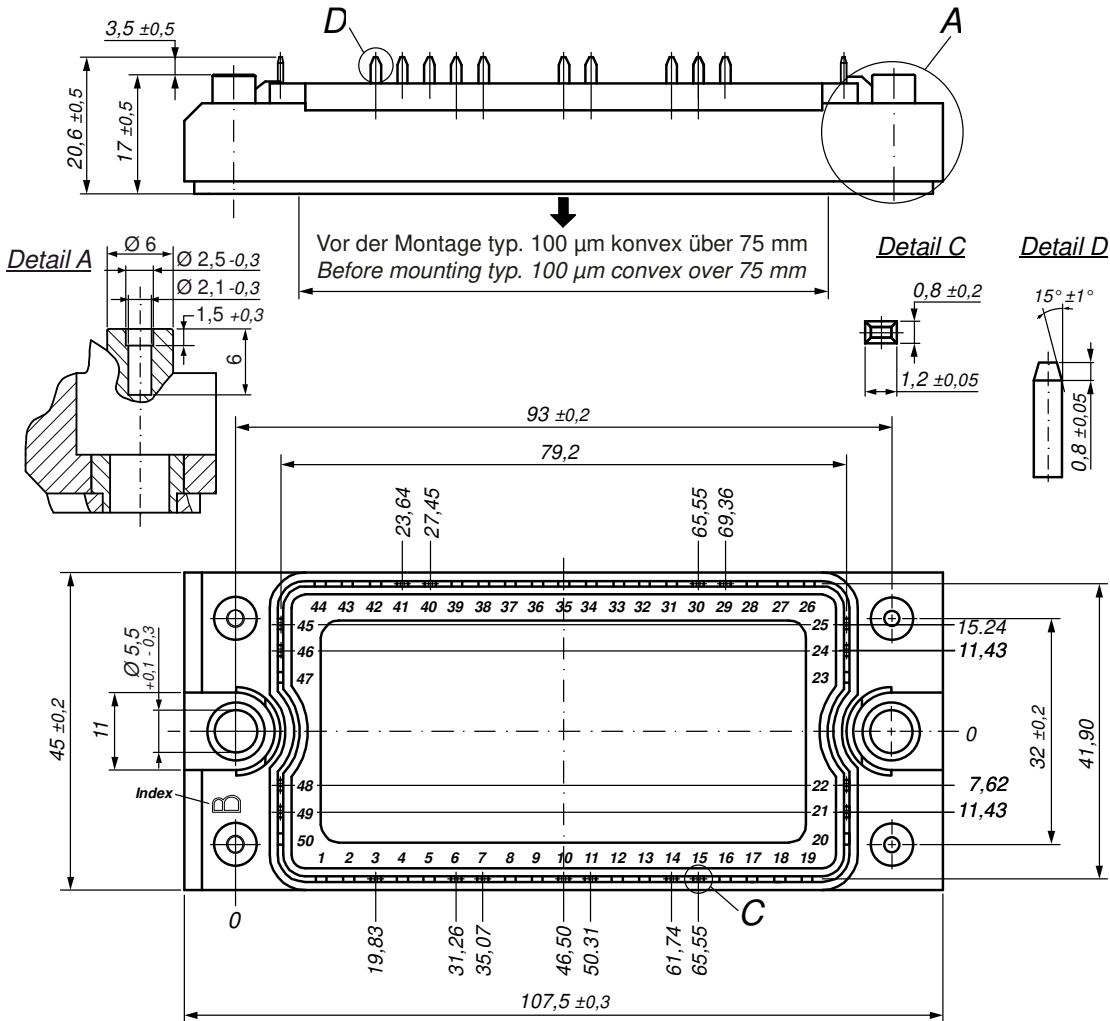
| | Rectifier | Brake IGBT | Brake Diode | |
|-------|-----------|------------|-------------|------------|
| V_0 | 0.8 | 1.1 | 1.31 | V |
| R_0 | 4.5 | 17.9 | 8 | m Ω |



Typ. NTC resistance vs. temperature



Outlines E2-Pack

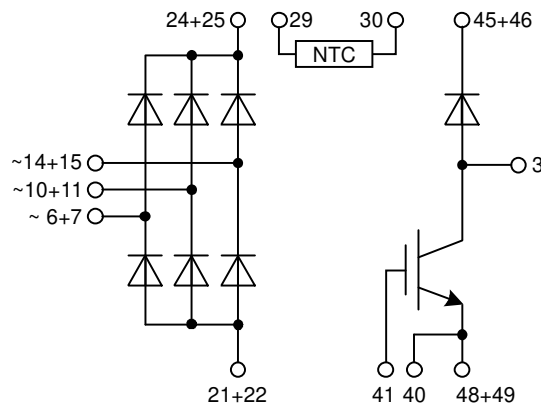


Bemerkung / Note:

- Nichttolerierete Maße nach / Measure without tolerances according DIN ISO 2768-T1-m
- PCB-Lochmuster / PCB hole pattern: **see pin position**
- Toleranz Pin-Position und PCB-Lochmuster / Tolerance of pin position and PCB hole pattern: $\oplus 0,1$
- Montageanleitung / Mounting instruction: www.ixys.com **Application note IXAN0024**

Detail A: PCB-Montage / Mounting on PCB ^L

- Empfohlene, selbstschneidende Schraube / Recommended, self-tapping screw: **EJOT PT®** (Größe / size: **K25**) ^L
- Max. Schraubenlänge / Max. screw length: **PCB-Dicke / thickness + 6 mm** (max. Lochtiefe / hole depth) ^L
- Empfohlenes Drehmoment / Recommended mounting torque: **1.5 Nm**



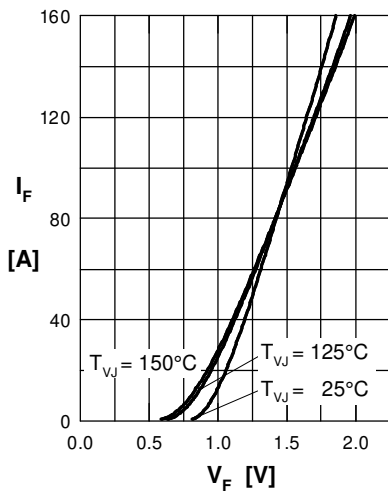
Rectifier


Fig. 1 Forward current versus voltage drop per diode

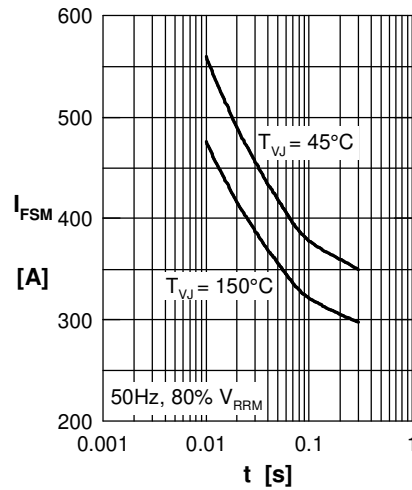


Fig. 2 Surge overload current vs. time per diode

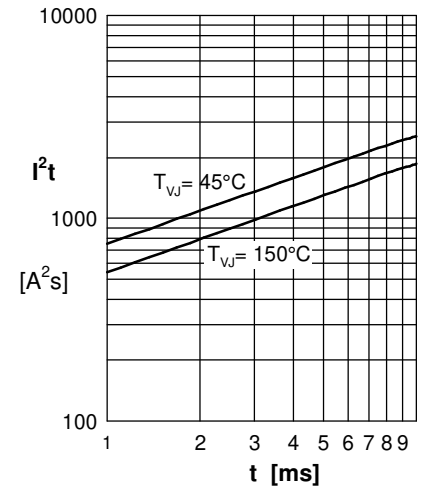
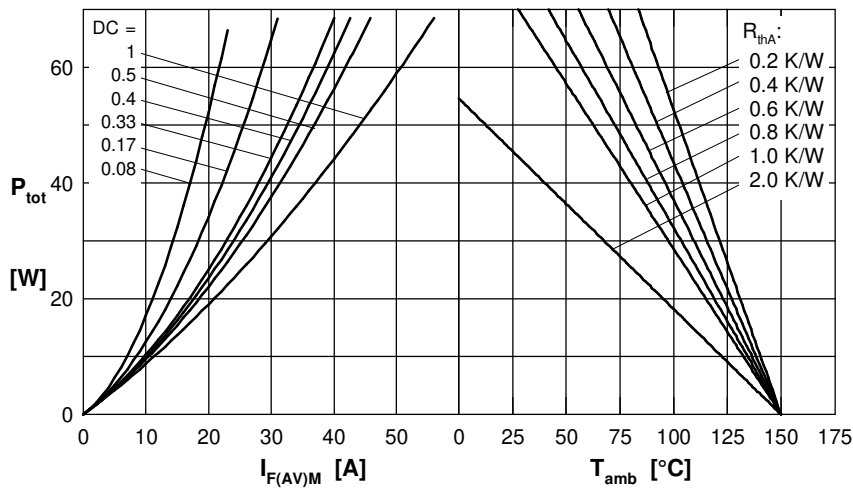

 Fig. 3 I^2t versus time per diode


Fig. 4 Power dissipation vs. forward current and ambient temperature per diode

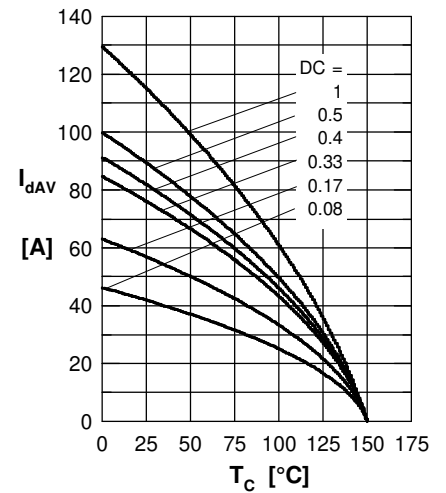


Fig. 5 Max. forward current vs. case temperature per diode

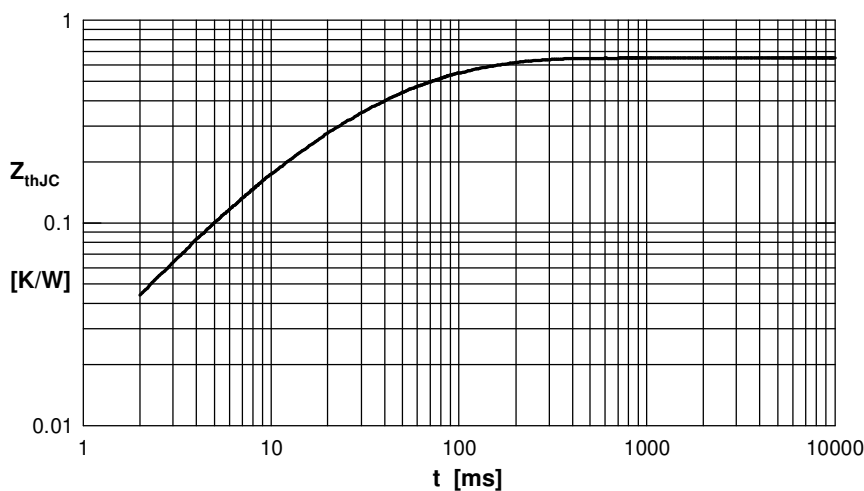


Fig. 6 Transient thermal impedance junction to case vs. time per diode

| R_i | t_i |
|-------|-------|
| 0.085 | 0.012 |
| 0.041 | 0.007 |
| 0.309 | 0.036 |
| 0.215 | 0.102 |

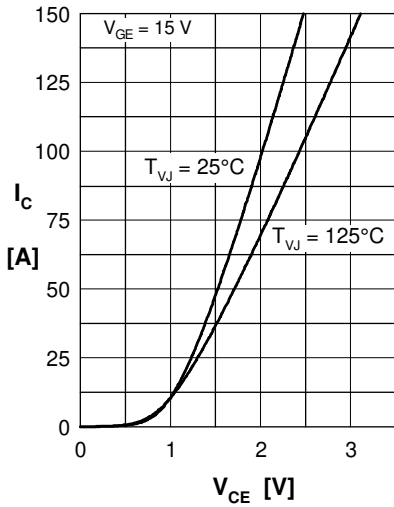
Brake IGBT


Fig. 1 Typ. output characteristics

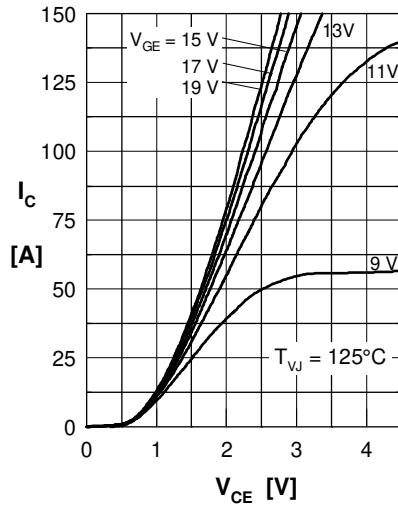


Fig. 2 Typ. output characteristics

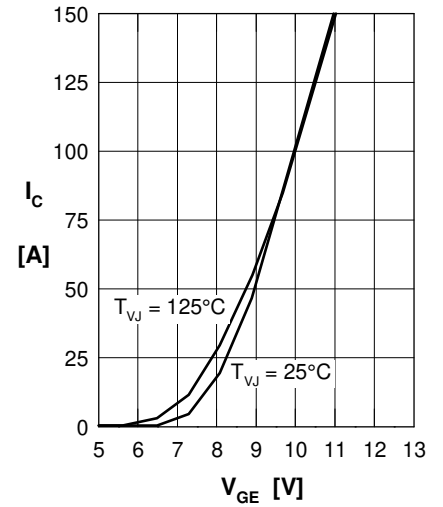


Fig. 3 Typ. transfer characteristics

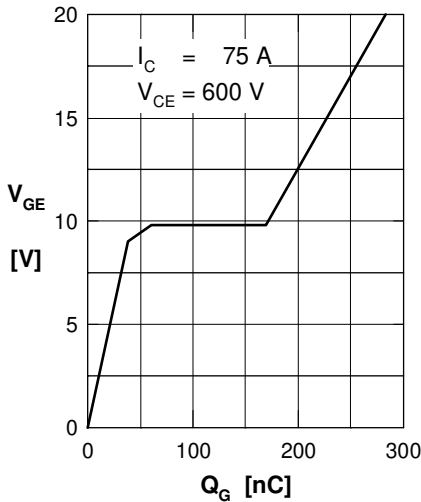


Fig. 4 Typ. turn-on gate charge

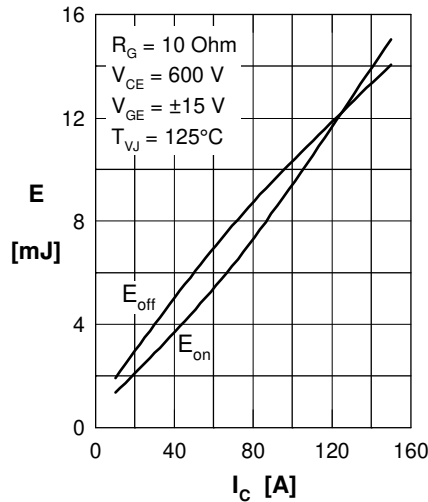


Fig. 5 Typ. switching energy versus collector current

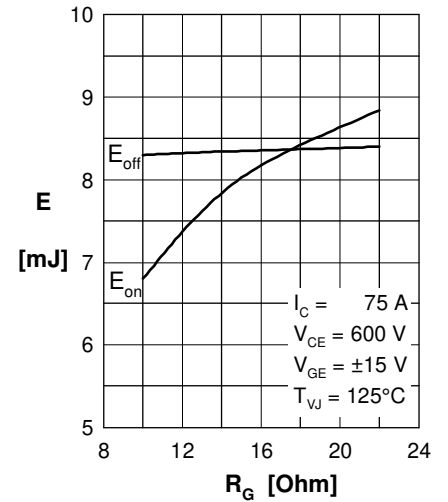


Fig. 6 Typ. switching energy versus gate resistance

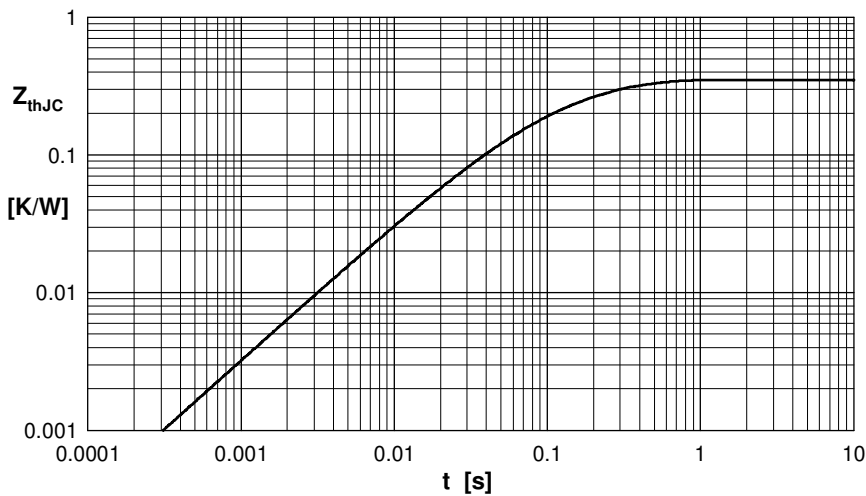


Fig. 7 Typ. transient thermal impedance junction to case



Brake Diode

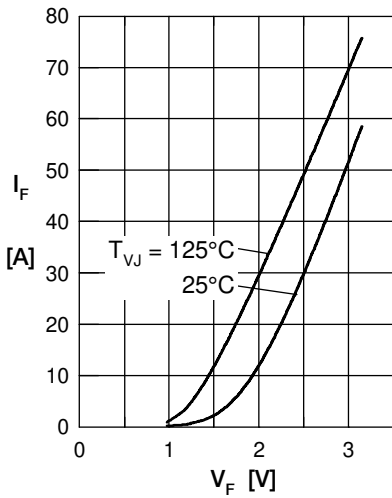


Fig. 1 Forward current I_F vs. V_F

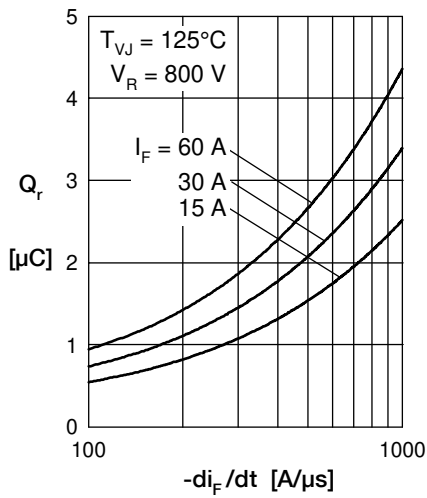


Fig. 2 Typ. reverse recovery charge Q_r versus $-di_F/dt$

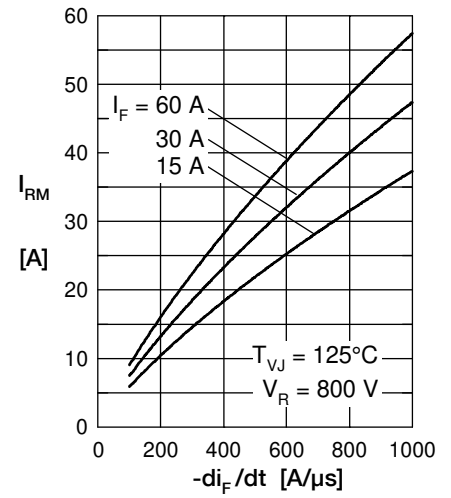


Fig. 3 Typ. peak reverse current I_{RM} versus $-di_F/dt$

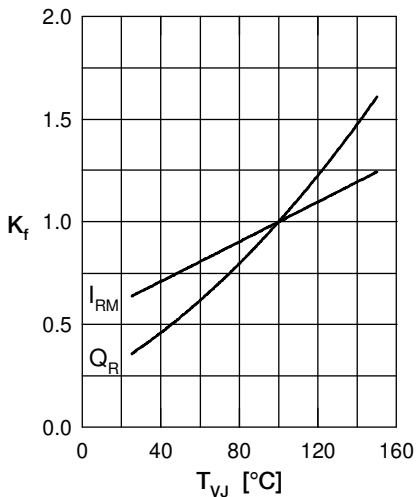


Fig. 4 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

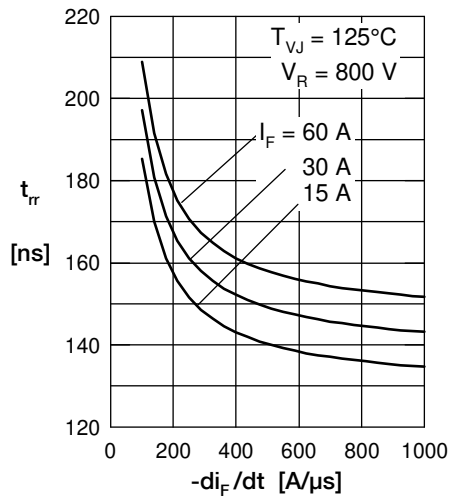


Fig. 5 Typ. recovery time t_{rr} versus $-di_F/dt$

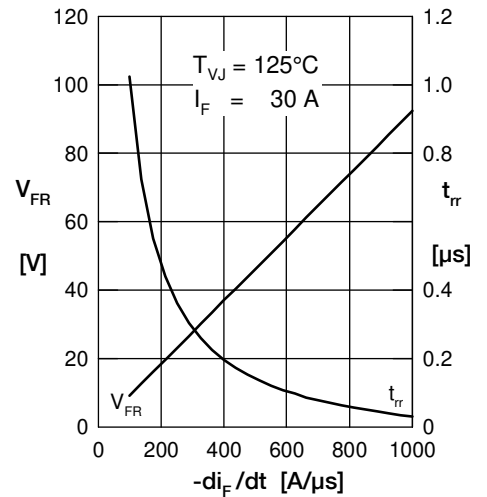


Fig. 6 Typ. peak forward voltage V_{FR} and t_{rr} versus di_F/dt

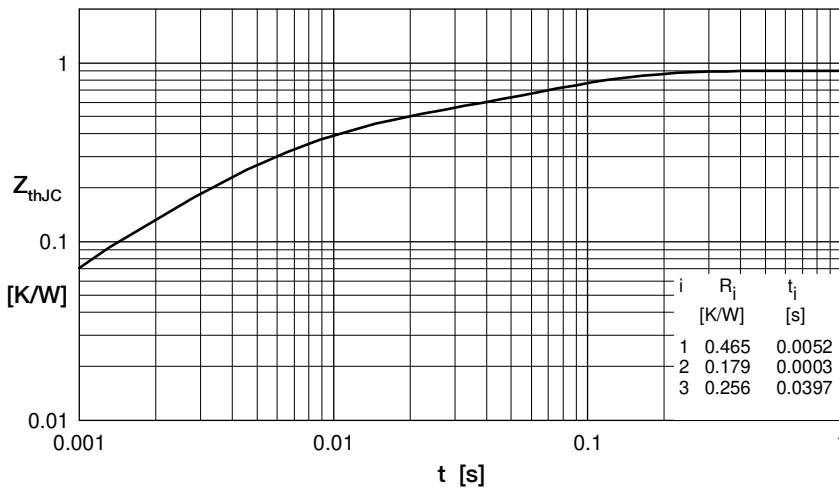


Fig. 7 Transient thermal impedance junction to case