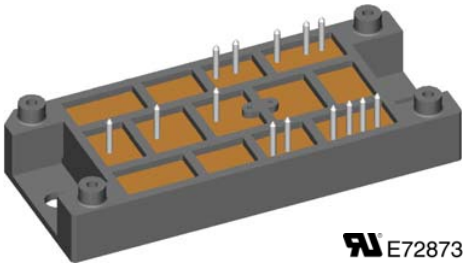
# Standard Rectifier Module

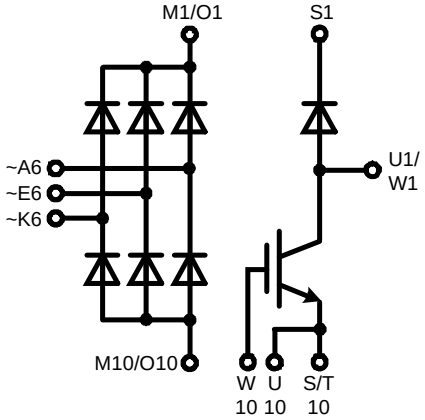
| 3 ~ Rectifier | Brake Chopper |
|---|---|
| $V_{RRM}$ = 1600 V | $V_{CES}$ = 1200 V |
| $I_{DAVM}$ = 188 A | $I_{C25}$ = 155 A |
| $I_{FSM}$ = 1100 A | $V_{CE(sat)}$ = 1.9 V |

3~ Rectifier Bridge + Brake Unit

**Part name**

VUB120-16NOX




**Features / Advantages:**

- Soldering connections for PCB mounting
- Convenient package outline

**Applications:**

- 3~ Rectifier with brake unit for drive inverters

**Package:**

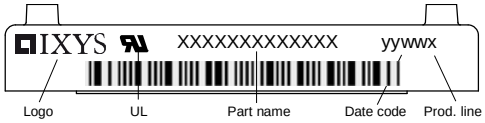
- Housing: V2-Pack
- DCB ceramic base plate
- Isolation voltage 3600 V~
- Easy to mount with two screws
- Space and weight savings
- RoHS compliant

| Rectifier | | | | Ratings | | | |
|---|---|---|---|---|---|---|---|
| Symbol | Definition | Conditions | | min. | typ. | max. | Unit |
| $V_{RSM}$ | *max. non-repetitive reverse blocking voltage* | | $T_{VJ}$ = 25°C | | | 1700 | V |
| $V_{RRM}$ | *max. repetitive reverse blocking voltage* | | $T_{VJ}$ = 25°C | | | 1600 | V |
| $I_R$ | *reverse current, drain current* | $V_{R/D}$ = 1600 V | $T_{VJ}$ = 25°C | | | 50 | µA |
| | | $V_{R/D}$ = 1600 V | $T_{VJ}$ = 125°C | | | 2 | mA |
| $V_F$ | *forward voltage drop* | $I_T$ = 60 A | $T_{VJ}$ = 25°C | | | 1.16 | V |
| | | $I_T$ = 120 A | | | | 1.36 | V |
| | | $I_T$ = 60 A | $T_{VJ}$ = 125°C | | | 1.09 | V |
| | | $I_T$ = 120 A | | | | 1.35 | V |
| $I_{D(AV)M}$ | *bridge output current* | $T_C$ = 80°C | $T_{VJ}$ = 150°C | | | 188 | A |
| | | rectangular d = ⅓ | | | | | |
| $V_{F0}$ | *threshold voltage* } *for power loss calculation only* | | $T_{VJ}$ = 150°C | | | 0.81 | V |
| $r_F$ | *slope resistance* } | | | | | 4.4 | mΩ |
| $R_{thJC}$ | *thermal resistance junction to case* | | | | | 0.60 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.2 | | K/W |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 200 | W |
| $I_{FSM}$ | *max. forward surge current* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 1.10 | kA |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 1.19 | kA |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 150°C | | | 935 | A |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 1.01 | kA |
| $I^2t$ | *value for fusing* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 6.05 | kA²s |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 5.89 | kA²s |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 150°C | | | 4.37 | kA²s |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 4.25 | kA²s |
| $C_J$ | *junction capacitance* | $V_R$ = 400 V f = 1 MHz | $T_{VJ}$ = 25°C | | 37 | | pF |

| Brake IGBT | | | | Ratings | | | |
|---|---|---|---|---|---|---|---|
| Symbol | Definition | Conditions | | min. | typ. | max. | Unit |
| $V_{CES}$ | *collector emitter voltage* | | $T_{VJ}$ = 25°C | | | 1200 | V |
| $V_{GES}$ | *max. DC gate voltage* | | | | | ±20 | V |
| $V_{GEM}$ | *max. transient collector gate voltage* | | | | | ±30 | V |
| $I_{C25}$ | *collector current* | | $T_C$ = 25°C | | | 155 | A |
| $I_{C80}$ | | | $T_C$ = 80°C | | | 107 | A |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 500 | W |
| $V_{CE(sat)}$ | *collector emitter saturation voltage* | $I_C$ = 100 A; $V_{GE}$ = 15 V | $T_{VJ}$ = 25°C | | 1.9 | 2.2 | V |
| | | | $T_{VJ}$ = 125°C | | 2.5 | | V |
| $V_{GE(th)}$ | *gate emitter threshold voltage* | $I_C$ = 4 mA; $V_{GE}$ = $V_{CE}$ | $T_{VJ}$ = 25°C | 5.4 | 5.9 | 6.5 | V |
| $I_{CES}$ | *collector emitter leakage current* | $V_{CE}$ = $V_{CES}$; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | | 0.1 | mA |
| | | | $T_{VJ}$ = 125°C | | 0.1 | | mA |
| $I_{GES}$ | *gate emitter leakage current* | $V_{GE}$ = ±20 V | | | | 500 | nA |
| $Q_{G(on)}$ | *total gate charge* | $V_{CE}$ = 600 V; $V_{GE}$ = 15 V; $I_C$ = 100 A | | | 295 | | nC |
| $t_{d(on)}$ | *turn-on delay time* | inductive load<br>$V_{CE}$ = 600 V; $I_C$ = 100 A<br>$V_{GE}$ = ±15 V; $R_G$ = 6.8 Ω | $T_{VJ}$ = 125°C | | 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* | | | | 8.5 | | mJ |
| $E_{off}$ | *turn-off energy per pulse* | | | | 11.5 | | mJ |
| RBSOA | *reverse bias safe operating area* | $V_{GE}$ = ±15 V; $R_G$ = 6.8 Ω | $T_{VJ}$ = 125°C | | | | |
| $I_{CM}$ | | $V_{CEK}$ = 1200 V | | | | 300 | A |
| SCSOA | *short circuit safe operating area* | | | | | | |
| $t_{SC}$ | *short circuit duration* | $V_{CE}$ = 720 V; $V_{GE}$ = ±15 V | $T_{VJ}$ = 125°C | | | 10 | µs |
| $I_{SC}$ | *short circuit current* | $R_G$ = 6.8 Ω; non-repetitive | | | 400 | | A |
| $R_{thJC}$ | *thermal resistance junction to case* | | | | | 0.25 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.1 | | K/W |

| Brake Diode | | | | | | | |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | *max. repetitive reverse voltage* | | $T_{VJ}$ = 25°C | | | 1200 | V |
| $I_{F25}$ | *forward current* | | $T_C$ = 25°C | | | 62 | A |
| $I_{F80}$ | | | $T_C$ = 80°C | | | 40 | A |
| $V_F$ | *forward voltage* | $I_F$ = 30 A | $T_{VJ}$ = 25°C | | | 2.71 | V |
| | | | $T_{VJ}$ = 125°C | | | 1.94 | V |
| $I_R$ | *reverse current* | $V_R$ = $V_{RRM}$ | $T_{VJ}$ = 25°C | | | 0.25 | mA |
| | | | $T_{VJ}$ = 125°C | | | 1 | mA |
| $Q_{rr}$ | *reverse recovery charge* | $V_R$ = 600 V | | | 1.8 | | µC |
| $I_{RM}$ | *max. reverse recovery current* | $-di_F/dt$ = 400 A/µs | $T_{VJ}$ = 125°C | | 23 | | A |
| $t_{rr}$ | *reverse recovery time* | $I_F$ = 30 A | | | 150 | | ns |
| $R_{thJC}$ | *thermal resistance junction to case* | | | | | 0.9 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.3 | | K/W |

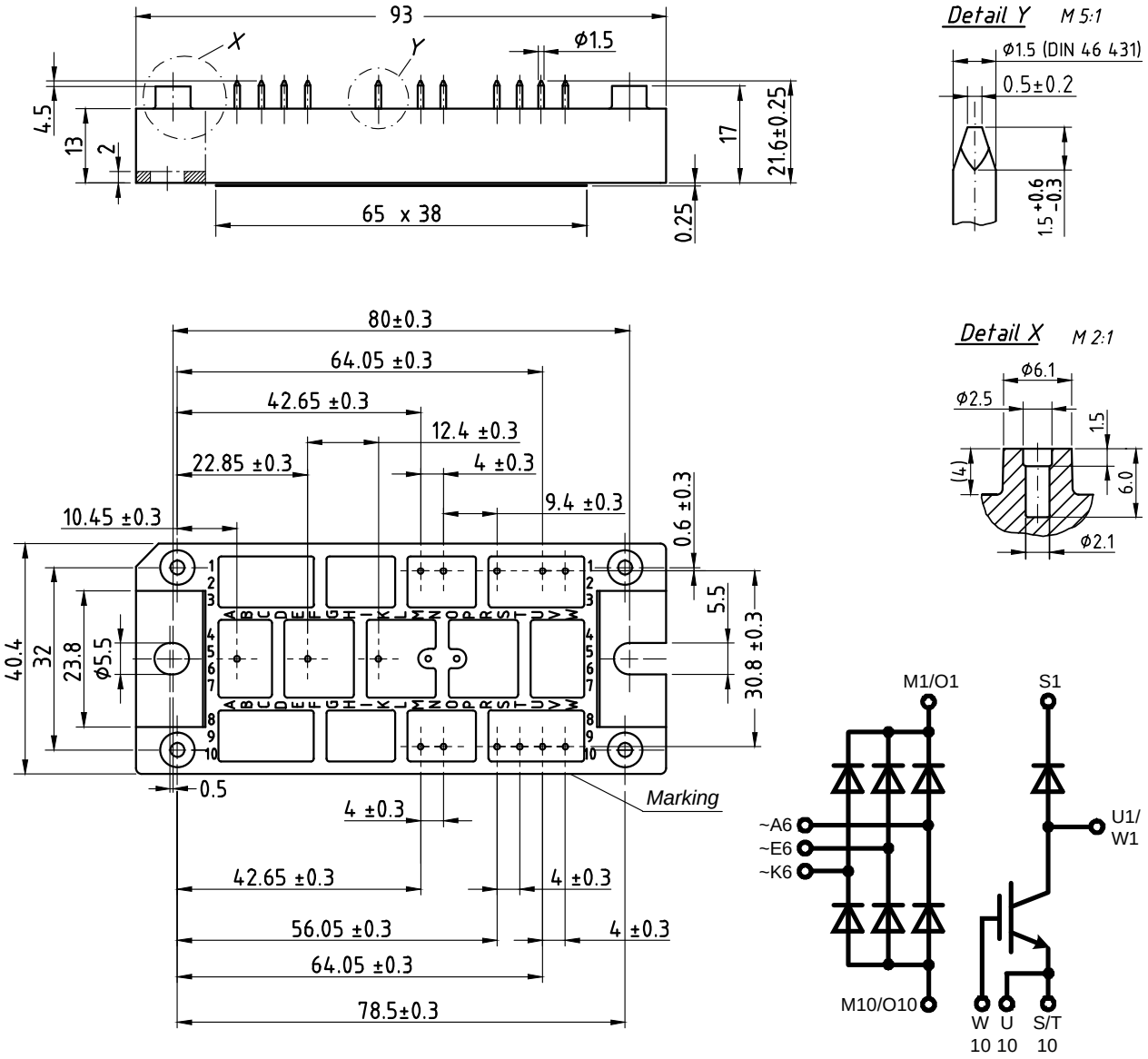
| Package V2-Pack | | | Ratings | | | |
|---|---|---|---|---|---|---|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| $I_{RMS}$ | $I_{RM}$ current | per terminal | | | 100 | A |
| $T_{stg}$ | storage temperature | | -40 | | 125 | °C |
| $T_{VJ}$ | virtual junction temperature | | -40 | | 150 | °C |
| Weight | | | | 76 | | g |
| $M_D$ | mounting torque | | 2 | | 2.5 | Nm |
| $V_{ISOL}$ | isolation voltage | t = 1 second | 3600 | | | V |
| | | t = 1 minute | 3000 | | | V |
| $d_{Spp/App}$ | creepage distance on surface \| striking distance through air | terminal to terminal | 6.0 | | | mm |
| $d_{Spb/Apb}$ | | terminal to backside | 12.0 | | | mm |




| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|---|---|---|---|---|---|
| Standard | VUB120-16NOX | VUB120-16NOX | Box | 6 | 510468 |

| Similar Part | Package | Voltage class |
|---|---|---|
| VUB120-16NOXT | V2-Pack | 1600 |

**Outlines**



## Rectifier

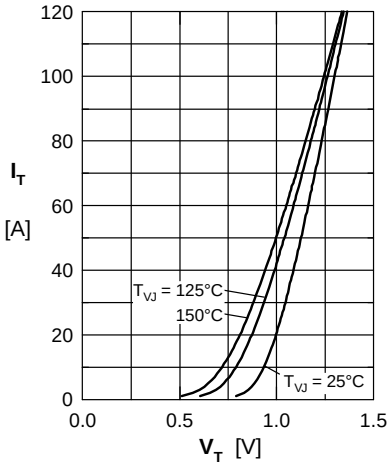



Fig.1 Forward current versus voltage drop per diode

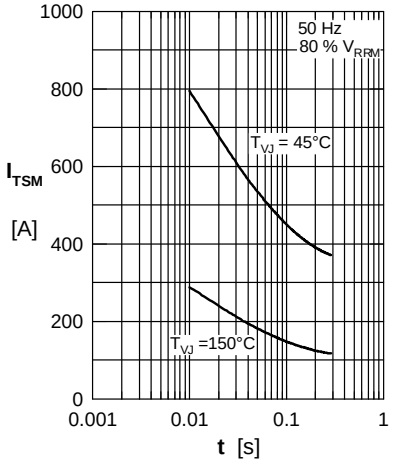



Fig.2 Surge overload current

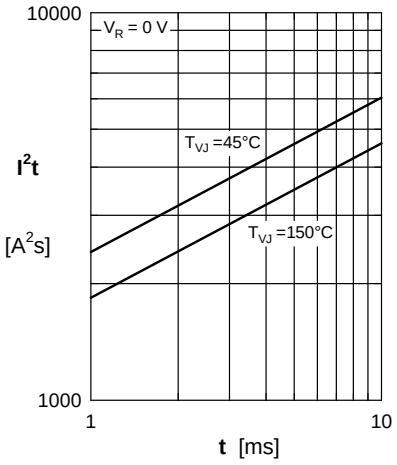



Fig.3 $I^2t$ versus time per diode

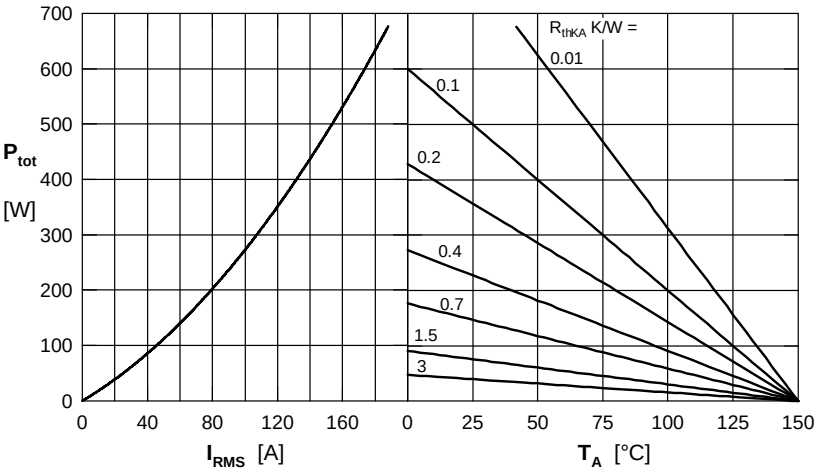



Fig.4 Power dissipation versus direct output current and ambient temperature, sine 180°

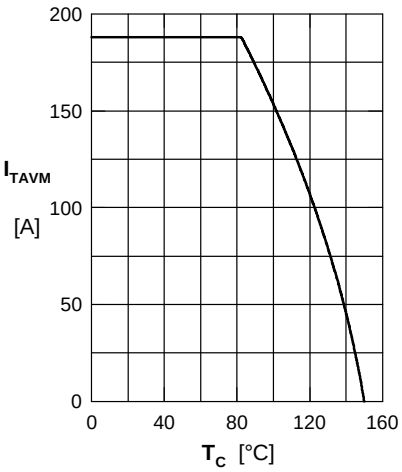



Fig. 5 Max. forward current vs. case temperature

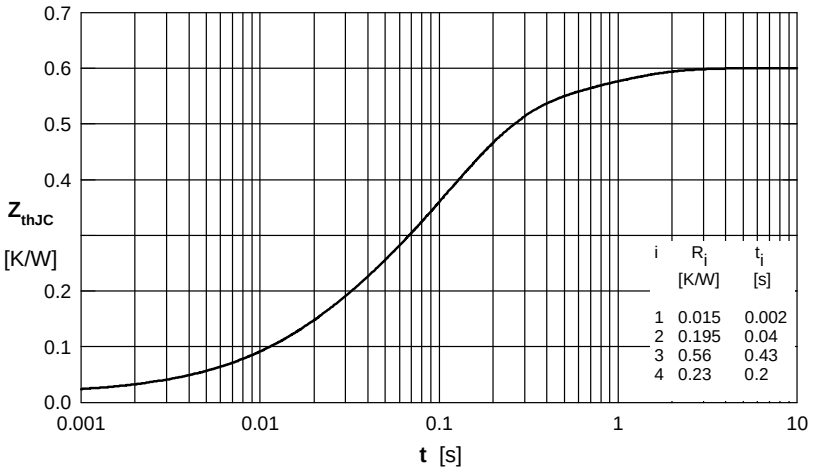



Fig. 6 Transient thermal impedance junction to case

## Brake IGBT

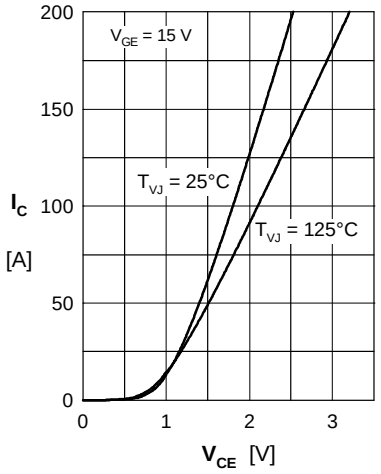



Fig. 1 Typ. output characteristics

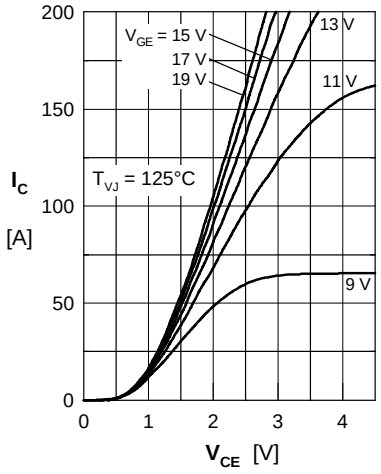



Fig. 2 Typ. output characteristics

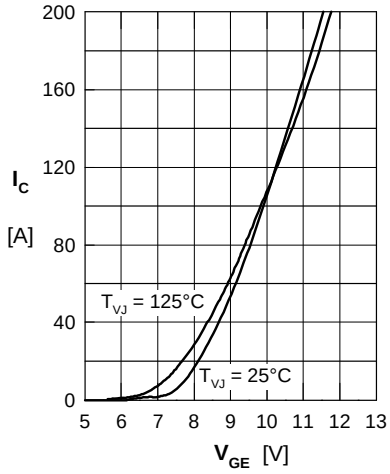



Fig. 3 Typ. transfer characteristics

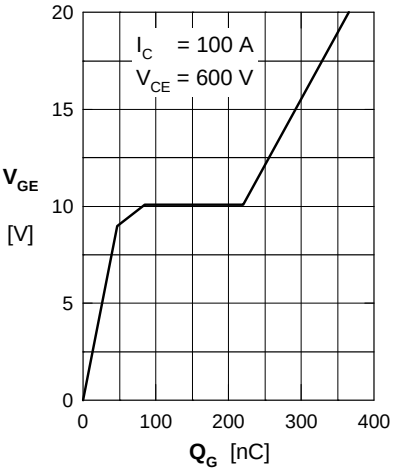



Fig. 4 Typ. turn-on gate charge

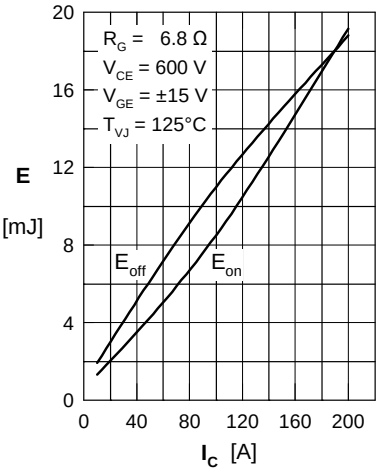



Fig. 5 Typ. switching energy versus collector current

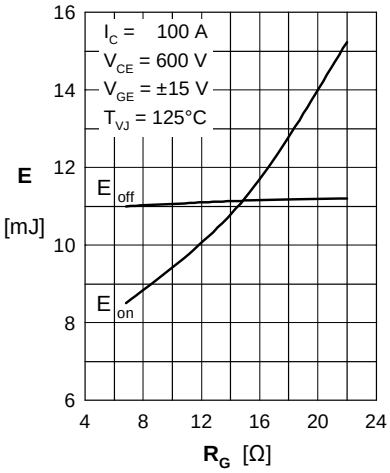



Fig. 6 Typ. switching energy versus gate resistance

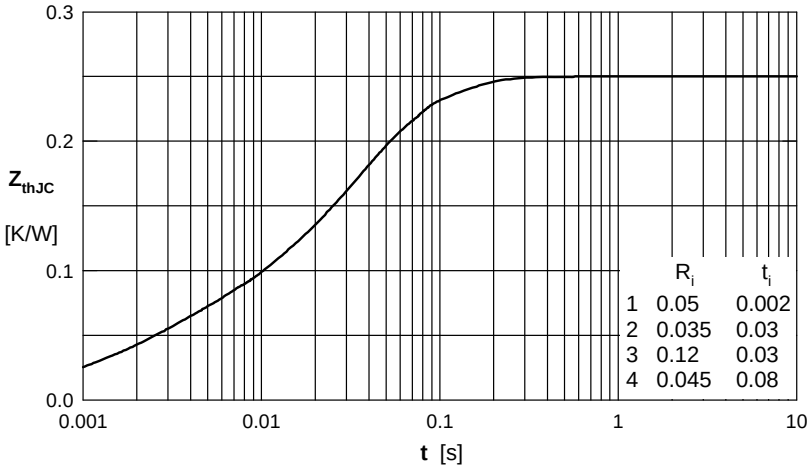



Fig. 7 Transient thermal impedance junction to case

## Brake Diode

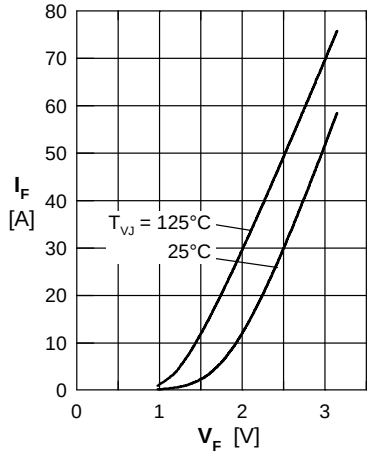



Fig. 1 Typ. forward current $I_F$ vs. $V_F$

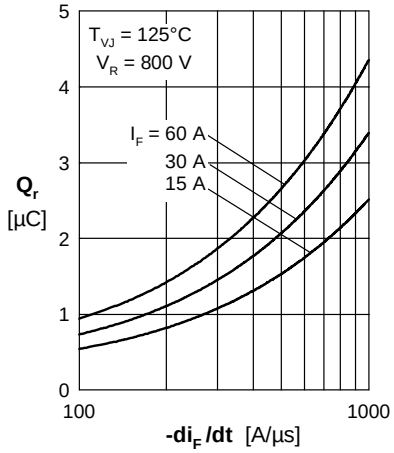



Fig. 2 Typ. reverse recovery charge $Q_r$ versus $-di_F/dt$

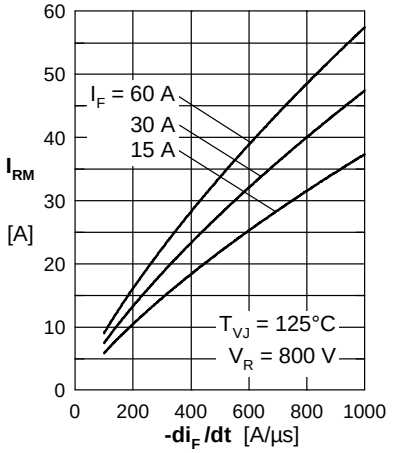



Fig. 3 Typ. peak reverse current $I_{RM}$ versus $-di_F/dt$

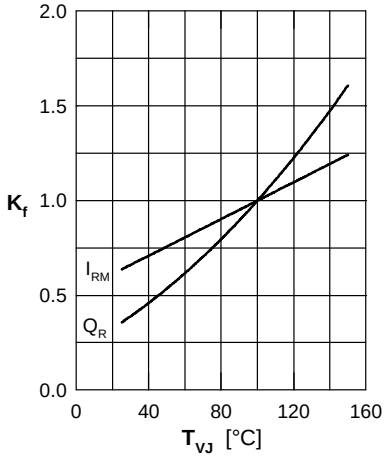



Fig. 4 Typ. dynamic parameters $Q_r$, $I_{RM}$, versus $T_{VJ}$

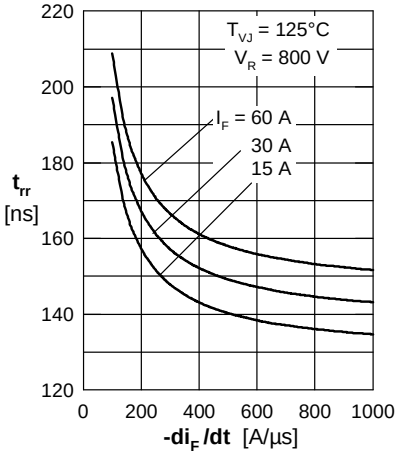



Fig. 5 Typ. recovery time $t_{rr}$ vs. $-di_F/dt$

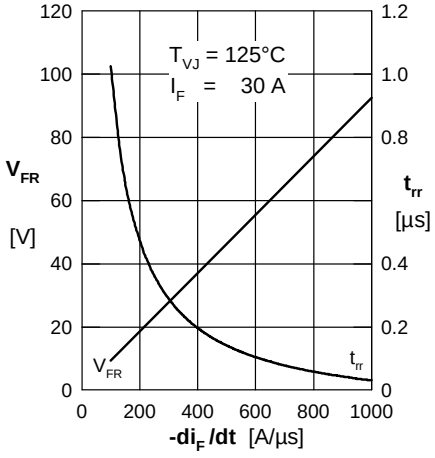



Fig. 6 Typ. peak forward voltage $V_{FR}$ and $t_{fr}$ versus $di_F/dt$

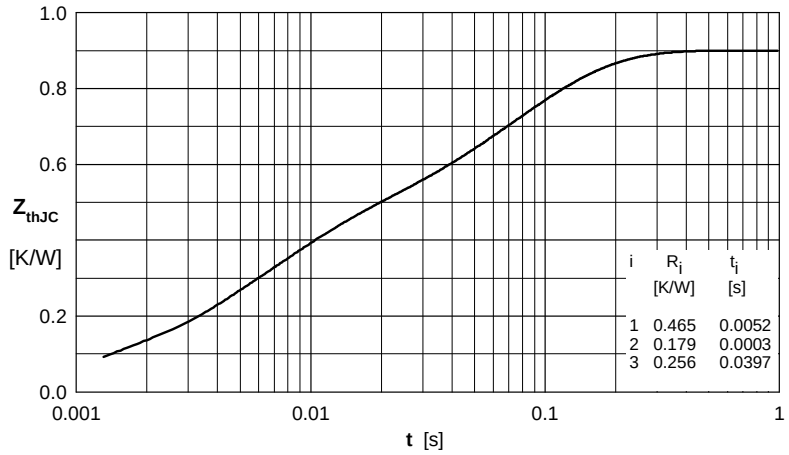



Fig. 7 Typ. transient thermal impedance junction to case