# Three Phase Rectifier Bridge

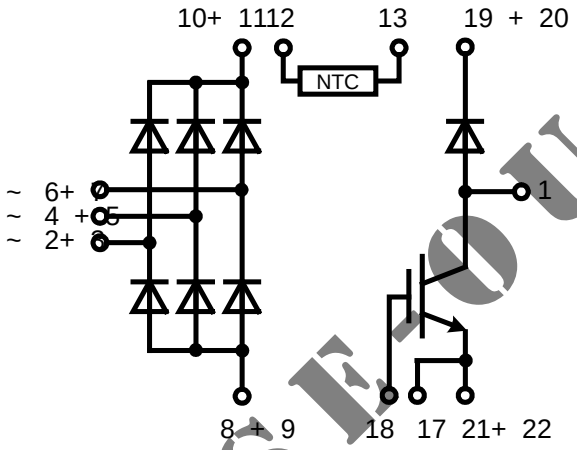
with IGBT and Fast Recovery Diode for Braking System

| Rectifier Diode | Fast Recov. Diode | IGBT |
|---|---|---|
| $V_{RRM}$ = 1600 V | $V_{CES}$ = 1200 V | $V_{CES}$ = 1200 V |
| $I_{dAVM}$ = 116 A | $V_F$ = 2.76 V | $I_{C80}$ = 67 A |
| $I_{FSM}$ = 700 A | $I_{FSM}$ = 200 A | $V_{CEsat}$ = 3.5V |

Preliminary data

**Part name** (Marking on product)

VUB 116-16NO1




E72873



**Features:**

- Soldering connections for PC Board mounting
- Convenient package outline
- Optional NTC

**Application:**

- Drive Inverters with brake system

**Package:**

- Two functions in one package
- Easy to mount with two screws
- Suitable for wave soldering
- High temperature and power cycling capability
- UL registered, E 72873

Recommended replacement:
VUB 116-16NOXT

## IGBT

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CES}$ | *collector emitter voltage* | | $T_{VJ}$ = 25 °C to 150 °C | | | 1200 | V |
| $V_{GES}$ | *max. DC gate voltage* | continuous | | -20 | | +20 | V |
| $V_{GEM}$ | *max. transient collector gate voltage* | transient | | -30 | | +30 | V |
| $I_{C25}$ | *collector current* | DC | $T_C$ = 25 °C | | | 95 | A |
| $I_{C80}$ | | DC | $T_C$ = 80 °C | | | 67 | A |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25 °C | | | 380 | W |
| $V_{CE(sat)}$ | *collector emitter saturation voltage* | $I_C$ = 100 A; $V_{GE}$ = 15 V | $T_{VJ}$ = 25 °C | | | 3.5 | V |
| $V_{GE(th)}$ | *gate emitter threshold voltage* | $I_C$ = 8 mA | $T_{VJ}$ = 25 °C | 4.5 | | 6.45 | |
| $I_{CES}$ | *collector emitter leakage current* | $V_{CE}$ = $V_{CES}$; $V_{GE}$ = 0 V | $T_{VJ}$ = 25 °C | | | 0.1 | mA |
| | | $V_{CE}$ = 0.8 $V_{CES}$; $V_{GE}$ = 0 V | $T_{VJ}$ = 125 °C | | | 0.5 | mA |
| $C_{ies}$ | *input capacitance* | $V_{CE}$ = 25 V; $V_{GE}$ = 0 V; f = 1 MHz | | | | 3.8 | |
| $t_{d(on)}$ | *turn-on delay time* | inductive load | $T_{VJ}$ = 125 °C | | 150 | | ns |
| $t_{d(off)}$ | *turn-off delay time* | $V_{CE}$ = 720 V; $I_C$ = 50 A | | | 680 | | ns |
| $E_{on}$ | *turn-on energy per pulse* | $V_{GE}$ = ±15 V; $R_G$ = 22 Ω; L = 100 µH | | | 6 | | mJ |
| $E_{off}$ | *turn-off energy per pulse* | | | | 4 | | mJ |
| $I_{CM}$ | *reverse bias safe operating area* | RBSOA; $V_{GE}$ = ±15 V; $R_G$ = 22 Ω; L = 100 µH | | | 100 | | A |
| $V_{CEK}$ | | clamped inductive load | $T_{VJ}$ = 125 °C | | | ≤ $V_{CES}$ - $L_s$ · di / dt | V |
| $t_{SC}$ | *short circuit safe operating area* | $V_{CE}$ = 720 V; $V_{GE}$ = ±15 V; | $T_{VJ}$ = 125 °C | | | 10 | µs |
| (SCSOA) | | $R_G$ = 22 Ω; non-repetitive | | | | | |
| RBSOA | *reverse bias safe operating area* | $V_{CE}$ = 1200 V; $V_{GE}$ = ±15 V; | $T_{VJ}$ = 125 °C | | | 100 | A |
| | | $R_G$ = 22 Ω; L = 100 µH; clamped inductive load | | | | | |
| $R_{thJC}$ | *thermal resistance junction to case* | | | | | 0.33 | K / W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.33 | | K / W |

## Fast Recovery Diode

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | *max. repetitive reverse voltage* | | $T_{VJ}$ = 150 °C | | | 1200 | V |
| $I_{FAV}$ | *average forward current* | rect.; d = 0.5 | $T_C$ = 80 °C | | | 27 | A |
| $I_{FRMS}$ | *rms forward current* | rect.; d = 0.5 | $T_C$ = 80 °C | | | 38 | A |
| $I_{FSM}$ | *max. surge forward current* | t = 10 ms | $T_{VJ}$ = 45 °C | | | 200 | A |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25 °C | | | 130 | W |
| $V_{F0}$ | *threshold voltage* | | $T_{VJ}$ = 150 °C | | | 1.3 | V |
| $r_F$ | *slope resistance* | for power loss calculation only | | | | 16 | mΩ |
| $V_F$ | *forward voltage* | $I_F$ = 30 A | $T_{VJ}$ = 25 °C | | | 2.76 | V |
| $I_R$ | *reverse current* | $V_R$ = $V_{RRM}$ | $T_{VJ}$ = 25 °C | | | 0.25 | mA |
| | | | $T_{VJ}$ = 125 °C | | | 1 | mA |
| $I_{RM}$ | *reverse recovery current* | $I_F$ = 50 A; $V_R$ = 100 V; -di$_F$/dt = -100 A/µs | | | 55 | 11 | A |
| $t_{rr}$ | *reverse recovery time* | $I_F$ = 1 A; $V_R$ = 30 V; -di$_F$/dt = -200 A/µs | | | 40 | | ns |
| $R_{thJC}$ | *thermal resistance junction to case* | | | | | 0.9 | K / W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.1 | | K / W |

$T_C$ = 25 °C unless otherwise stated

## Rectifier Diode

| Symbol | Conditions | | | Ratings min. | typ. | max. | |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | *max. repetitive reverse voltage* | | $T_{VJ}$ = 25 °C | | 1600 | | V |
| $I_R$ | *reverse current* | $V_R = V_{RRM}$ | $T_{VJ}$ = 25 °C | | 0.1 | | mA |
| | | | $T_{VJ}$ = 150 °C | | 2 | | mA |
| $V_F$ | *forward voltage* | $I_F$ = 80 A | $T_{VJ}$ = 25 °C | | 1.43 | | V |
| $I_{D(AV)M}$ | *max. average DC output current* | rectangular; d = 1/3; bridge | $T_C$ = 80 °C | | 116 | | A |
| $V_{F0}$ | *threshold voltage* | | $T_{VJ}$ = 150 °C | | 0.85 | | V |
| $r_F$ | *slope resistance* | *for power loss calculation only* | | | 7.1 | | mΩ |
| $R_{thJC}$ | *thermal resistance junction to case* | per diode | $T_{VJ}$ = 25 °C | | 0.65 | | K / W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | $T_{VJ}$ = 25 °C | | 0.1 | | K / W |
| $P_{tot}$ | *total power dissipation* | | $T_{VJ}$ = 25 °C | | 190 | | W |
| $I_{FSM}$ | *max. forward surge current* | t = 10 ms (50Hz) | $T_{VJ}$ = 45 °C | | 700 | | A |
| | | $V_R$ = 0 V | $T_{VJ}$ = 150 °C | | 610 | | A |
| $I^2t$ | *value for fusing* | t = 10 ms (50Hz) | $T_{VJ}$ = 45 °C | | 2450 | | $A^2s$ |
| | | $V_R$ = 0 V | $T_{VJ}$ = 150 °C | | 1860 | | $A^2s$ |

## Temperature Sensor NTC

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $R_{25}$ | *resistance* | $T_C$ = 25 °C | | 4.75 | 5.00 | 5.25 | kΩ |
| $B_{25/85}$ | | | | | 3375 | | K |

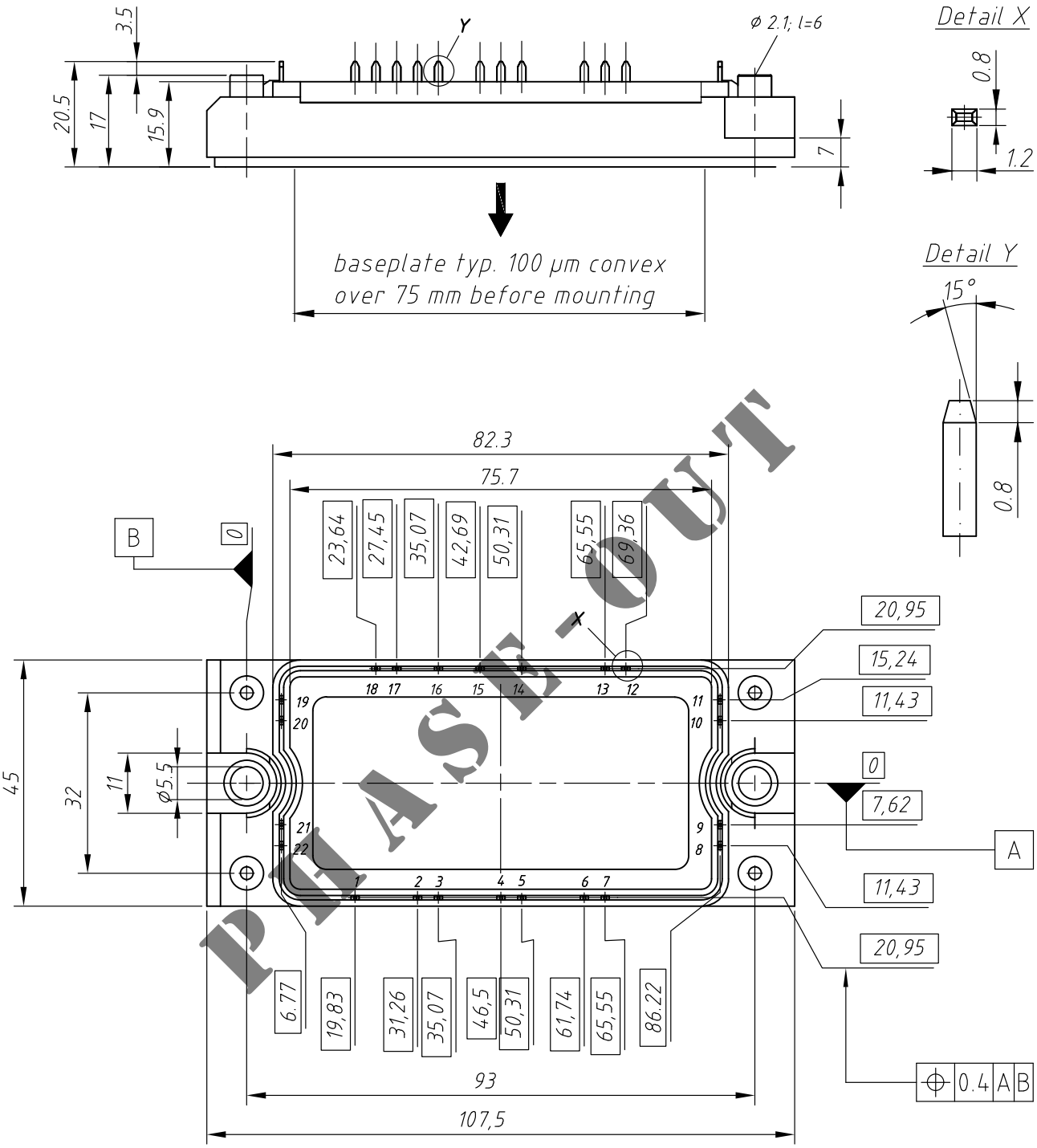
## Module

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $T_{VJ}$ | *operating temperature* | | | -40 | | 125 | °C |
| $T_{VJM}$ | *max. virtual junction temperature* | | | | | 150 | °C |
| $T_{stg}$ | *storage temperature* | | | -40 | | 125 | °C |
| $V_{ISOL}$ | *isolation voltage* | $I_{ISOL} \leq$ 1 mA; 50/60 Hz; | t = 1 min. | | | 2500 | V ~ |
| | | | t = 1 s | | | 3000 | V ~ |
| $M_d$ | *mounting torque* | (M5) | | 2.7 | | 3.3 | N m |
| $d_S$ | *creep distance on surface* | | | 12.7 | | | mm |
| $d_A$ | *strike distance through air* | | | 9.6 | | | mm |
| a | *maximum allowable acceleration* | | | | | 50 | $m/s^2$ |
| $R_{pin-chip}$ | *thermal resistance pin to chip* | $T_{VJ}$ = 25 °C | | | 2 | | Ωm |
| **Weight** | | | | | 180 | | g |

$T_C$ = 25 °C unless otherwise stated

## Outline Drawing

Dimensions in mm ( 1 mm = 0.0394 “)






## Product Marking

| Ordering | Part Name | Marking on | Product Delivering Mode | Base Qty | Ordering Code |
|---|---|---|---|---|---|
| Standard | VUB 116-16N O 1 | VUB 116-16N O 1 | Box | 6 | 496855 |

IXYS reserves the right to change limits, test conditions and dimensions.

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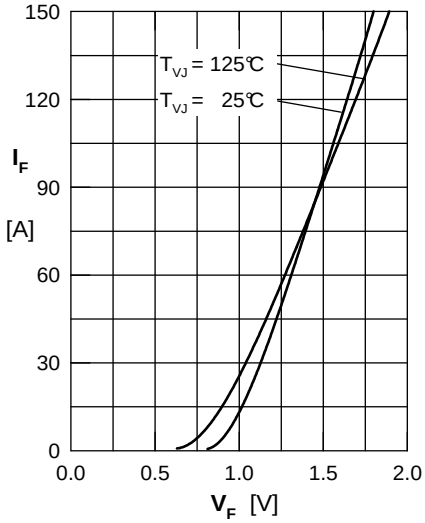


Fig. 1 Forward current vs. voltage drop per diode

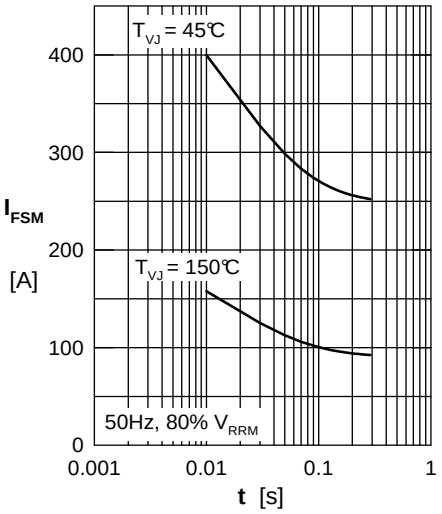


Fig. 2 Surge overload current

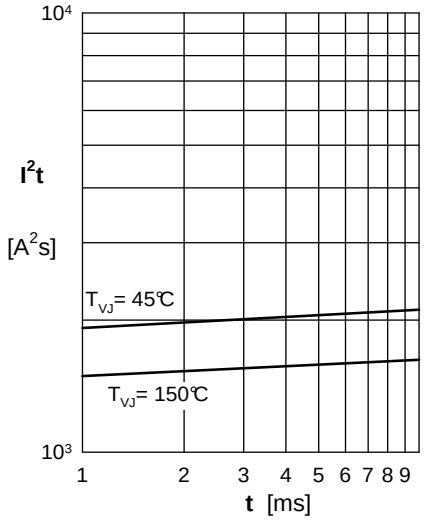


Fig. 3 $I^2t$ versus time per diode

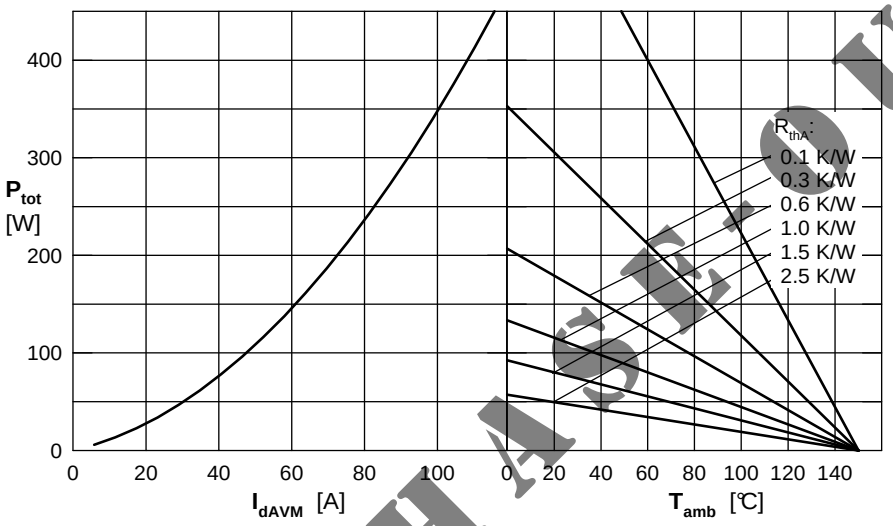


Fig. 4 Power dissipation versus direct output current and ambient temperature, sine 180°

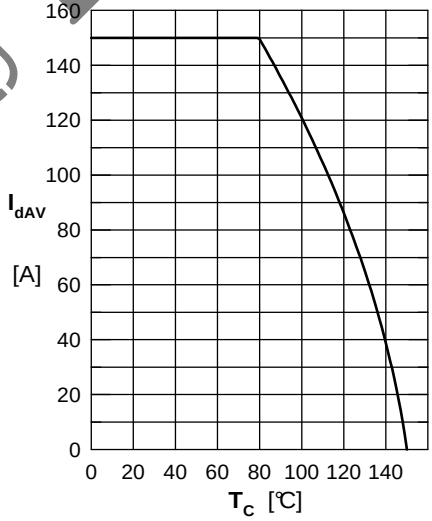


Fig. 5 Max. forward current vs. case temperature

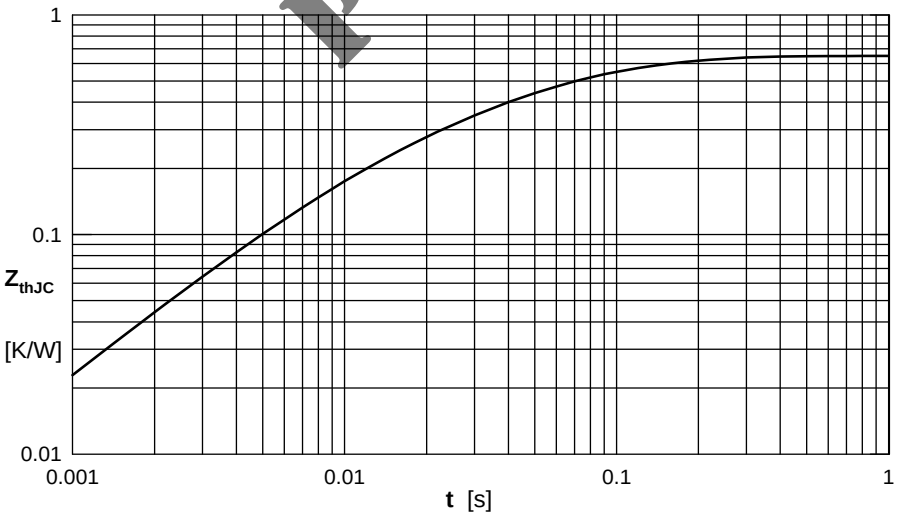


Fig. 6 Transient thermal impedance junction to case

| $R_i$ | $\tau_i$ |
|---|---|
| 0.085 | 0.012 |
| 0.041 | 0.007 |
| 0.309 | 0.036 |
| 0.215 | 0.102 |

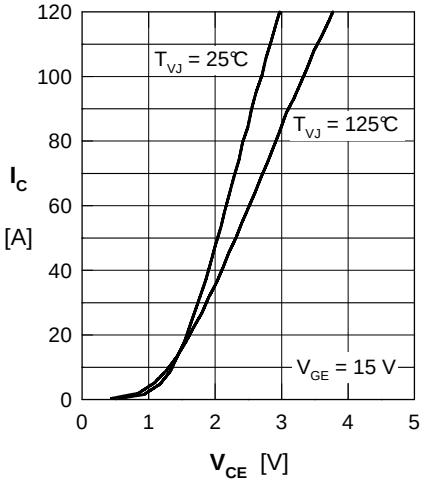


Fig. 7 Typ. output characteristics

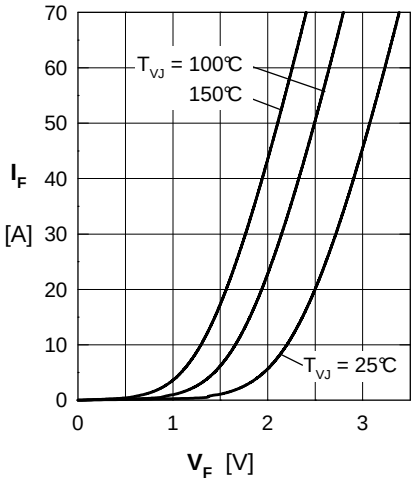


Fig. 8 Typ. forward characteristics of free wheeling diode

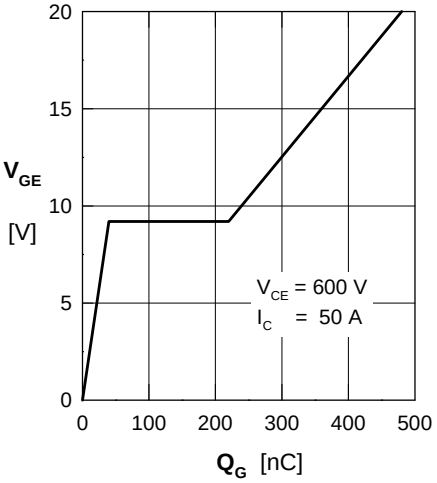


Fig. 9 Typ. turn on gate charge

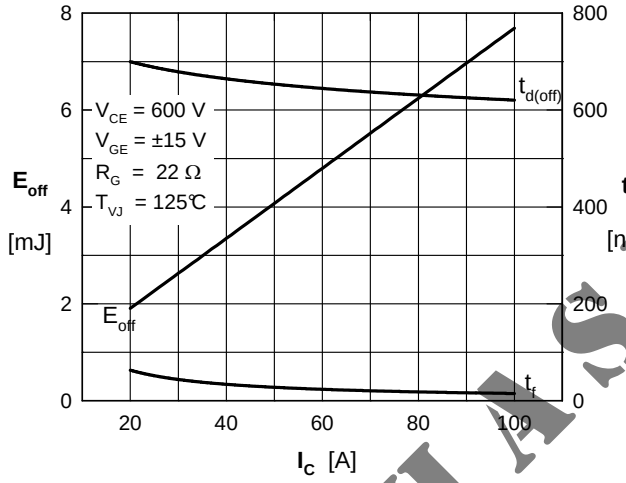


Fig. 10 Typ. turn off energy and switching times versus collector current

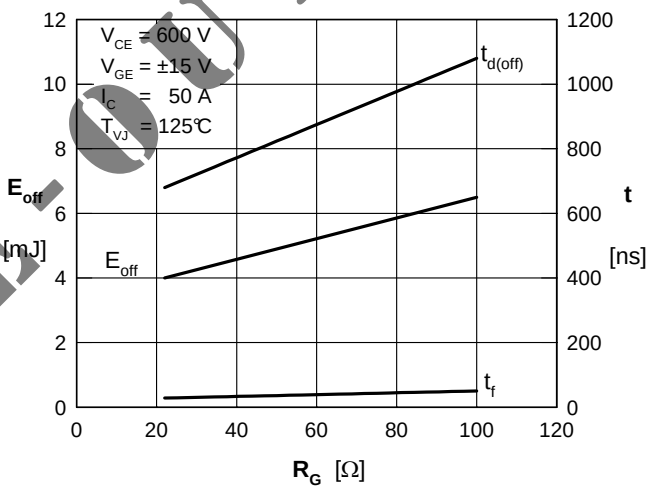


Fig. 11 Typ. turn off energy and switching times versus gate resistor

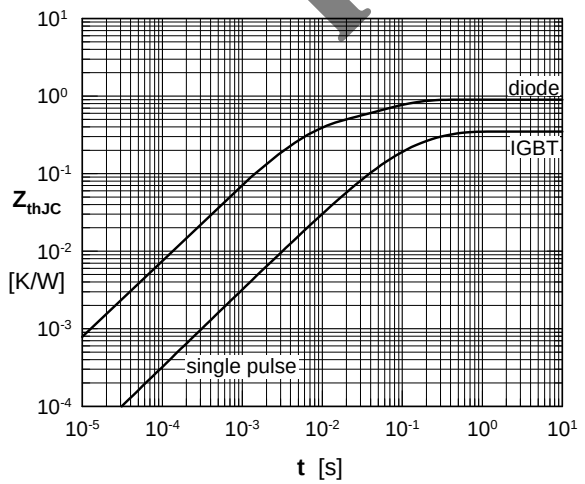


Fig. 12 Typ. transient thermal impedance

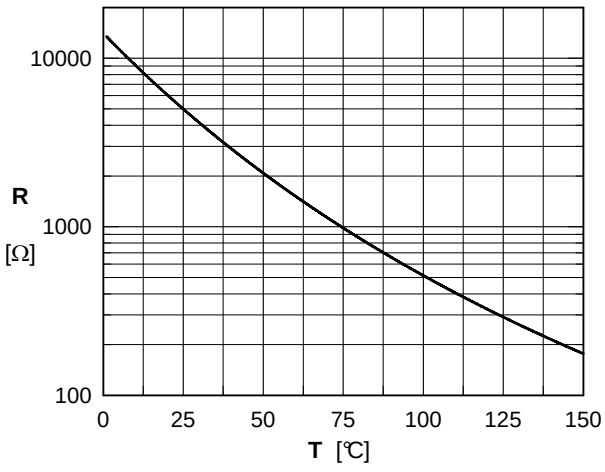


Fig. 13 Typ. thermistor resistance vs. temperature