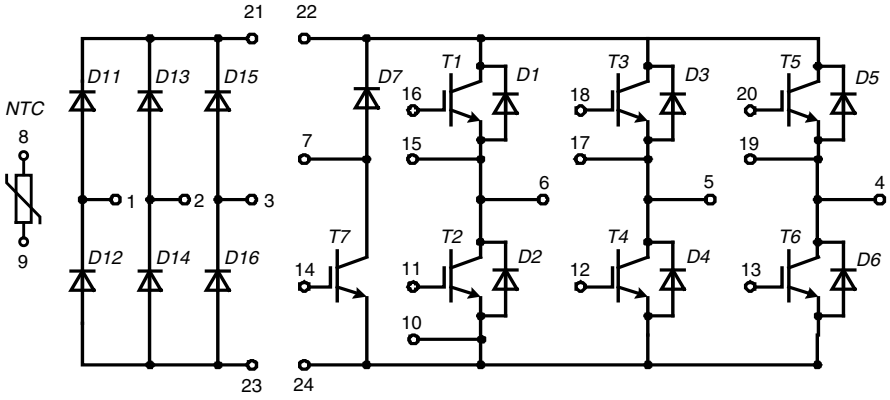
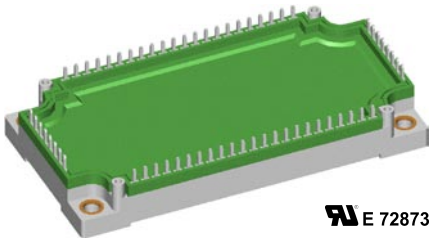
# Converter - Brake - Inverter Module (CBI3) with Trench IGBT technology




| Three Phase Rectifier | Brake Chopper | Three Phase Inverter |
|---|---|---|
| $V_{RRM}$ = 1600 V | $V_{CES}$ = 1200 V | $V_{CES}$ = 1200 V |
| $I_{FAVM}$ = 50 A | $I_{C25}$ = 55 A | $I_{C25}$ = 80 A |
| $I_{FSM}$ = 850 A | $V_{CE(sat)}$ = 1.7 V | $V_{CE(sat)}$ = 1.7 V |

## Input Rectifier Bridge D11 - D16

| Symbol | Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{RRM}$ | | 1600 | V |
| $I_{FAV}$ | $T_C$ = 80°C; sine 180° | 50 | A |
| $I_{DAVM}$ | $T_C$ = 80°C; rectangular; d = $^1/_3$; bridge | 140 | A |
| $I_{FSM}$ | $T_C$ = 25°C; t = 10 ms; sine 50 Hz | 850 | A |
| $P_{tot}$ | $T_C$ = 25°C | 125 | W |

| Symbol | Conditions | | Characteristic Values ($T_{VJ}$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|---|
| $V_F$ | $I_F$ = 50 A; | $T_{VJ}$ = 25°C | | 1.15 | 1.3 | V |
| | | $T_{VJ}$ = 125°C | | 1.05 | | V |
| $I_R$ | $V_R = V_{RRM}$; | $T_{VJ}$ = 25°C | | | 0.05 | mA |
| | | $T_{VJ}$ = 125°C | | 0.8 | | mA |
| $R_{thJC}$ | (per diode) | | | | 1.0 | K/W |

**Application: AC motor drives with**

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

**Features**

- High level of integration - only one power semiconductor module required for the whole drive
- IGBT technology with low saturation voltage, low switching losses and tail current, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

## Output Inverter T1 - T6

| Symbol | Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_{VJ}$ = 25°C to 150°C | 1200 | V |
| $V_{GES}$ | Continuous | ± 20 | V |
| $I_{C25}$ | $T_C$ = 25°C | 80 | A |
| $I_{C80}$ | $T_C$ = 80°C | 50 | A |
| $I_{CM}$ | $T_C$ = 80°C; $t_p$ = 1 ms | 100 | A |
| $P_{tot}$ | $T_C$ = 25°C | 270 | W |

| Symbol | Conditions | | Characteristic Values ($T_{VJ}$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|---|
| $V_{CE(sat)}$ | $I_C$ = 50 A; $V_{GE}$ = 15 V | $T_{VJ}$ = 25°C | | 1.7 | 2.15 | V |
| | | $T_{VJ}$ = 125°C | | 2.0 | | V |
| $V_{GE(th)}$ | $I_C$ = 2 mA; $V_{GE}$ = $V_{CE}$ | | 5 | 5.8 | 6.5 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | | 2.7 | mA |
| | | $T_{VJ}$ = 125°C | | 0.7 | | mA |
| $I_{GES}$ | $V_{CE}$ = 0 V; $V_{GE}$ = ± 20 V | | | | 400 | nA |
| $C_{ies}$ | $V_{CE}$ = 25 V; $V_{GE}$ = 0 V; f = 1 MHz | | | 3.5 | | nF |
| $Q_{Gon}$ | $V_{CE}$ = 600 V; $V_{GE}$ = 15 V; $I_C$ = 50 A | | | 470 | | nC |
| $t_{d(on)}$ | Inductive load, $T_{VJ}$ = 125°C | | | 90 | | ns |
| $t_r$ | $V_{CE}$ = 600 V; $I_C$ = 50 A | | | 50 | | ns |
| $t_{d(off)}$ | $V_{GE}$ = ±15 V; $R_G$ = 18 Ω | | | 520 | | ns |
| $t_f$ | | | | 90 | | ns |
| $E_{on}$ | | | | 5 | | mJ |
| $E_{off}$ | | | | 6.5 | | mJ |
| **RBSOA** | $I_C$ = $I_{CM}$; $V_{GE}$ = 15 V; $R_G$ = 18 Ω; $T_{VJ}$ = 125°C | | $V_{CEK} \leq V_{CES}$ - $L_S$ di/dt | | | V |
| $t_{SC}$ **(SCSOA)** | $V_{CE}$ = 720 V; $V_{GE}$ = ±15 V; $R_G$ = 18 Ω; $t_P \leq$ 10 µs; non-repetitive; $T_{VJ}$ = 125°C | | | 200 | | A |
| $R_{thJC}$ | | | | | 0.46 | K/W |

## Output Inverter D1 - D6

| Symbol | Conditions | Maximum Ratings | |
|---|---|---|---|
| $I_{F25}$ | $T_C$ = 25°C | 100 | A |
| $I_{F80}$ | $T_C$ = 80°C | 50 | A |

| Symbol | Conditions | | Characteristic Values min. | typ. | max. | |
|---|---|---|---|---|---|---|
| $V_F$ | $I_F$ = 50 A; | $T_{VJ}$ = 25°C | | 2.1 | 2.6 | V |
| | | $T_{VJ}$ = 125°C | | 1.6 | | V |
| $I_{RM}$ | $I_F$ = 60 A; $di_F/dt$ = -1200 A/µs; | | | 90 | | A |
| $Q_{rr}$ | $T_{VJ}$ = 125°C; $V_R$ = 600 V; $V_{GE}$ = 0 V | | | 10 | | µC |
| $t_{rr}$ | | | | 160 | | ns |
| $E_{rec}$ | | | | 4 | | mJ |
| $R_{thJC}$ | (per diode) | | | | 0.65 | K/W |

## Brake Chopper T7

| Symbol | Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_{VJ}$ = 25°C to 150°C | 1200 | V |
| $V_{GES}$ | Continuous | ± 20 | V |
| $I_{C25}$ | $T_C$ = 25°C | 55 | A |
| $I_{C80}$ | $T_C$ = 80°C | 35 | A |
| $I_{CM}$ | $T_C$ = 80°C; $t_p$ = 1 ms | 70 | A |
| $P_{tot}$ | $T_C$ = 25°C | 200 | W |

| Symbol | Conditions | | Characteristic Values ($T_{VJ}$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|---|
| $V_{CE(sat)}$ | $I_C$ = 35 A; $V_{GE}$ = 15 V | $T_{VJ}$ = 25°C | | 1.7 | 2.15 | V |
| | | $T_{VJ}$ = 125°C | | 2.0 | | V |
| $V_{GE(th)}$ | $I_C$ = 1.5 mA; $V_{GE}$ = $V_{CE}$ | | 5 | 5.8 | 6.5 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | | 0.25 | mA |
| | | $T_{VJ}$ = 125°C | | 0.3 | | mA |
| $I_{GES}$ | $V_{CE}$ = 0 V; $V_{GE}$ = ± 20 V | | | | 400 | nA |
| $C_{ies}$ | $V_{CE}$ = 25 V; $V_{GE}$ = 0 V; f = 1 MHz | | | 2.5 | | nF |
| $Q_{Gon}$ | $V_{CE}$ = 600 V; $V_{GE}$ = 15 V; $I_C$ = 35 A | | | 330 | | nC |
| $t_{d(on)}$ | Inductive load, $T_{VJ}$ = 125°C | | | 90 | | ns |
| $t_r$ | $V_{CE}$ = 600 V; $I_C$ = 35 A | | | 50 | | ns |
| $t_{d(off)}$ | $V_{GE}$ = ±15 V; $R_G$ = 27 Ω | | | 520 | | ns |
| $t_f$ | | | | 90 | | ns |
| $E_{off}$ | | | | 4.8 | | mJ |
| **RBSOA** | $I_C$ = $I_{CM}$; $V_{GE}$ = 15 V; $R_G$ = 27 Ω; $T_{VJ}$ = 125°C | | $V_{CEK} \leq V_{CES} - L_S$ di/dt | | | V |
| $t_{SC}$ **(SCSOA)** | $V_{CE}$ = 720 V; $V_{GE}$ = ±15 V; $R_G$ = 27 Ω; $t_P \leq$ 10 µs; non-repetitive; $T_{VJ}$ = 125°C | | | 140 | | A |
| $R_{thJC}$ | | | | | 0.62 | K/W |

## Brake Chopper D7

| Symbol | Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{RRM}$ | $T_{VJ}$ = 25°C to 150°C | 1200 | V |
| $I_{F25}$ | $T_C$ = 25°C | 48 | A |
| $I_{F80}$ | $T_C$ = 80°C | 30 | A |

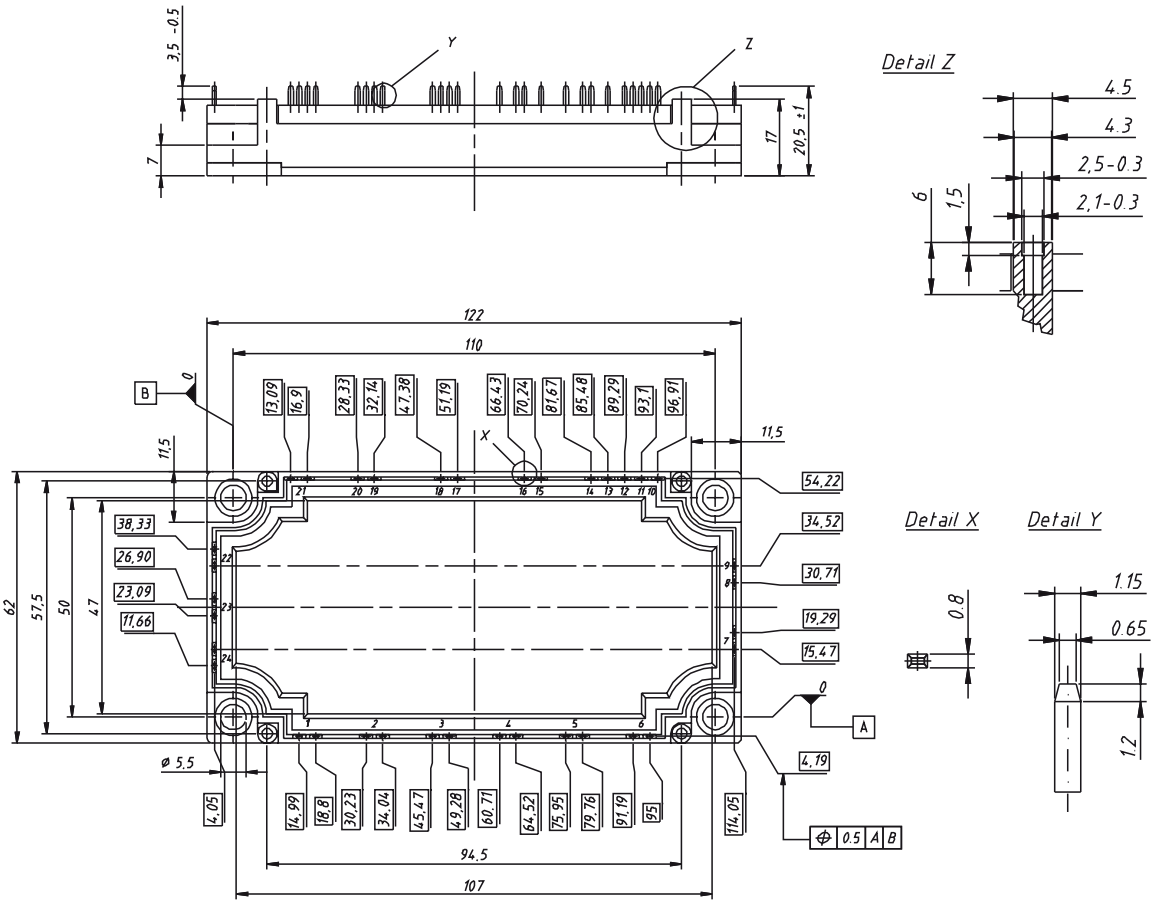
| Symbol | Conditions | | Characteristic Values min. | typ. | max. | |
|---|---|---|---|---|---|---|
| $V_F$ | $I_F$ = 35 A; | $T_{VJ}$ = 25°C | | 2.5 | 3.3 | V |
| | | $T_{VJ}$ = 125°C | | 2.0 | | V |
| $I_R$ | $V_R$ = $V_{RRM}$; | $T_{VJ}$ = 25°C | | | 0.25 | mA |
| | | $T_{VJ}$ = 125°C | | 0.5 | | mA |
| $R_{thJC}$ | (per diode) | | | | 1.2 | K/W |

| Temperature Sensor NTC | | | | | |
|---|---|---|---|---|---|
| **Symbol** | **Conditions** | **Characteristic Values** | | | |
| | | **min.** | **typ.** | **max.** | |
| $R_{25}$ | T = 25°C | 4.75 | 5.0 | 5.25 | kΩ |
| $B_{25/50}$ | | | 3375 | | K |

| Module | | | |
|---|---|---|---|
| **Symbol** | **Conditions** | **Maximum Ratings** | |
| $T_{VJ}$ | operating | -40...+125 | °C |
| $T_{JM}$ | | +150 | °C |
| $T_{stg}$ | | -40...+125 | °C |
| $V_{ISO}$ | $I_{ISOL} \leq 1$ mA; 50/60 Hz | 2500 | V~ |
| $M_d$ | Mounting torque (M5) | 3 - 6 | Nm |

| **Symbol** | **Conditions** | **Characteristic Values** | | | |
|---|---|---|---|---|---|
| | | **min.** | **typ.** | **max.** | |
| $R_{therm-chip}$ | Resistance terminal to chip | | 5 | | mΩ |
| $d_S$ | Creepage distance on surface | 6 | | | mm |
| $d_A$ | Strike distance in air | 6 | | | mm |
| $R_{thCH}$ | with heatsink compound | | 0.01 | | K/W |
| **Weight** | | | 300 | | g |

**Dimensions in mm (1 mm = 0.0394")**




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

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## Input Rectifier Bridge D11 - D16

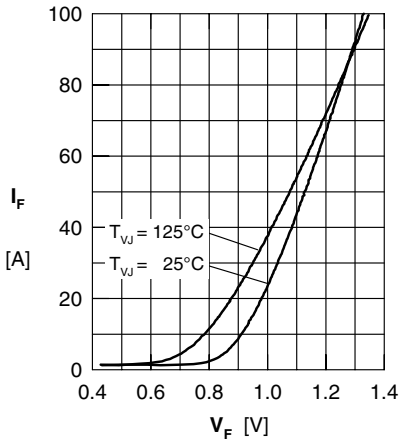


Fig. 1 Typ. forward current vs. voltage drop per diode

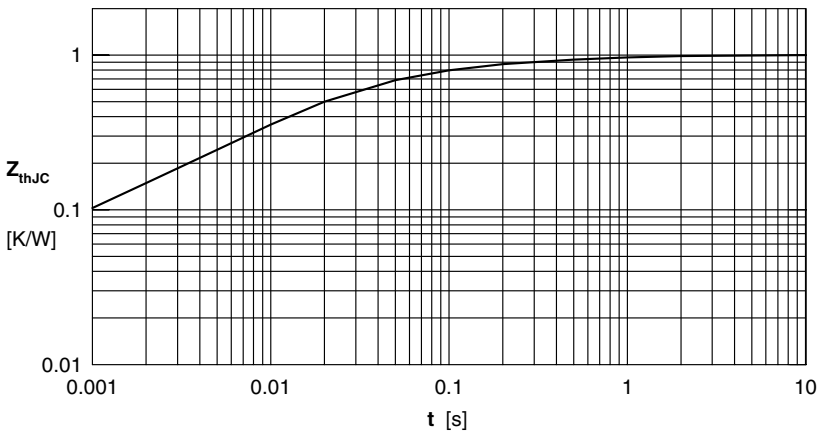


Fig. 2 Transient thermal impedance junction to case

**Output Inverter T1 - T6 / D1 - D6**

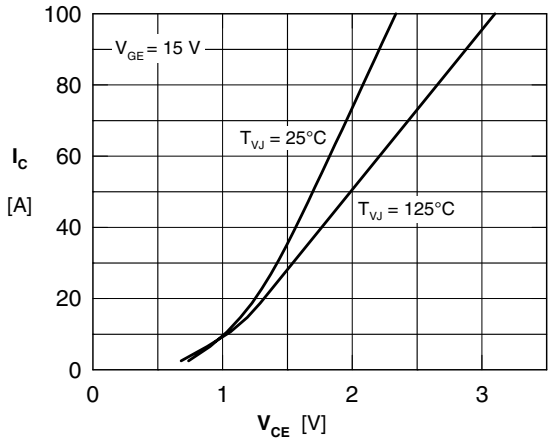


Fig. 3 Typical output characteristic

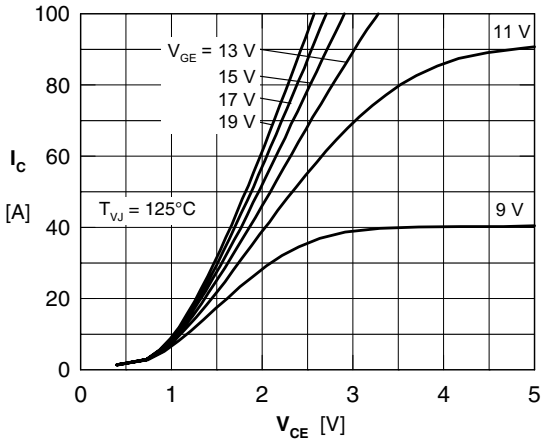


Fig. 4 Typical output characteristic

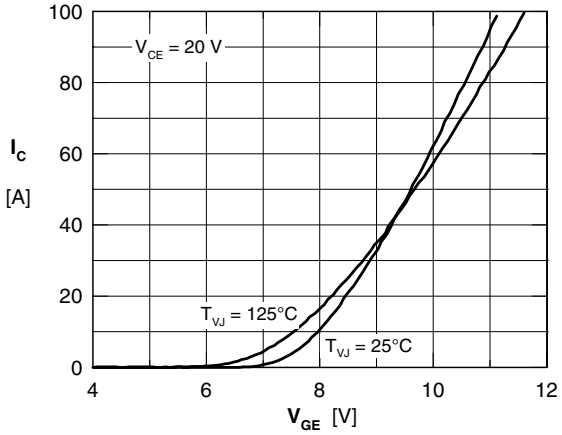


Fig. 5 Typical transfer characteristic

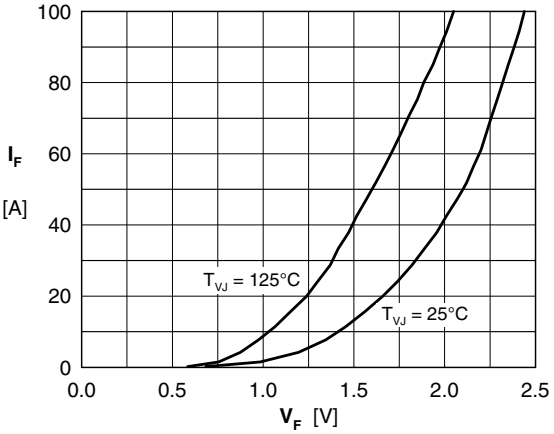


Fig. 6 Typical forward characteristic of free wheeling diode

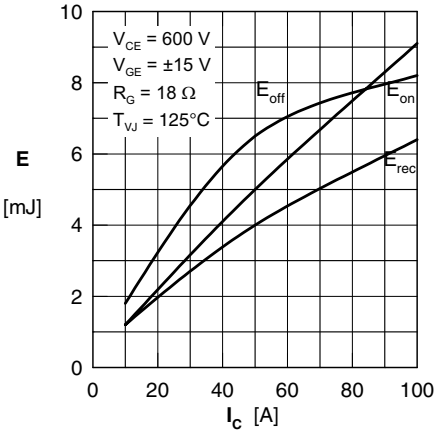


Fig. 7 Typ. switching losses vs. collector current

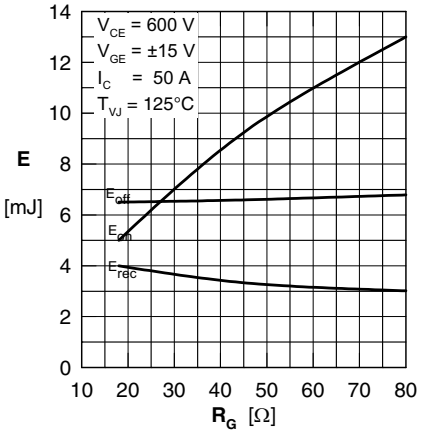


Fig. 8 Typ. switching losses vs. gate resistance

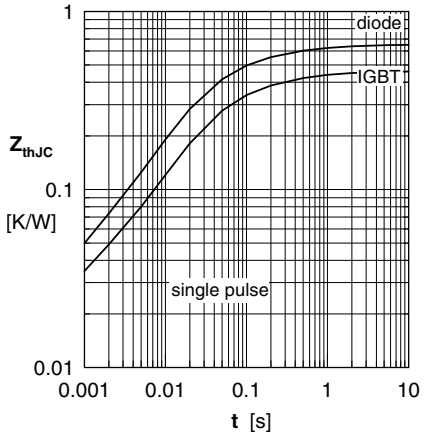


Fig. 9 Transient thermal impedance

## Brake Chopper T7 / D7

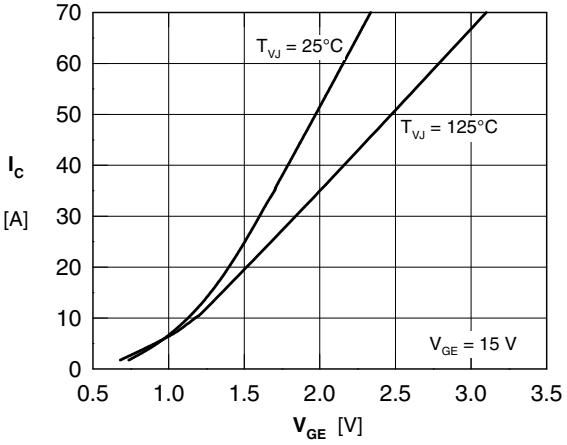


Fig. 10 Typical output characteristics

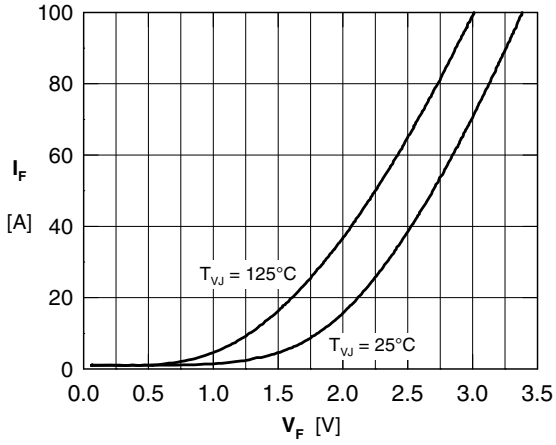


Fig. 11 Typical forward characteristics of free wheeling diode

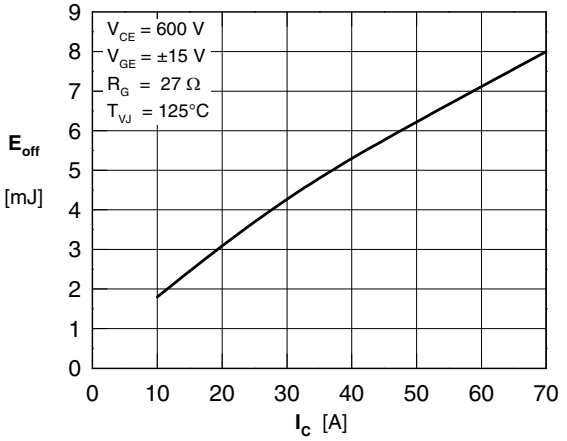


Fig. 12 Typ. turn off energy vs. collector current

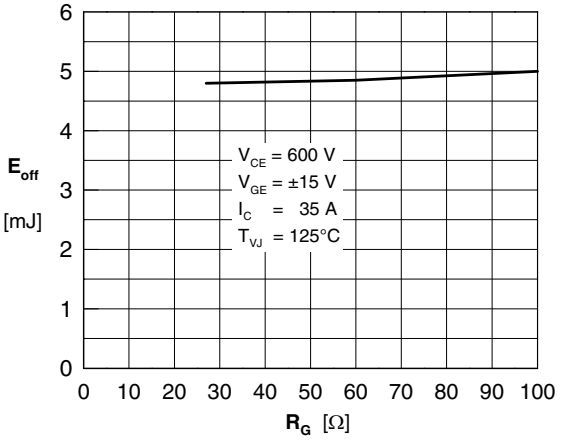


Fig. 13 Typ. turn off energy versus gate

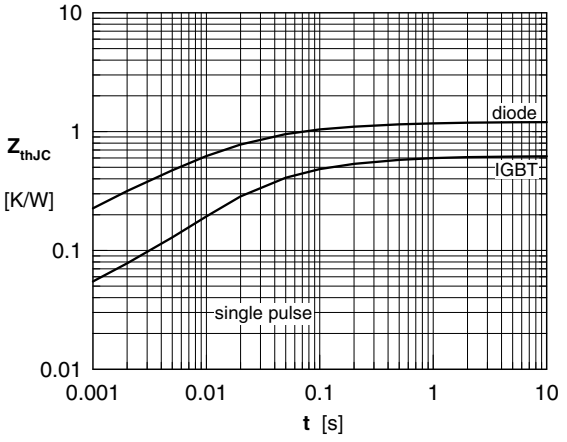


Fig. 14 Transient thermal impedance

### Temperature Sensor NTC

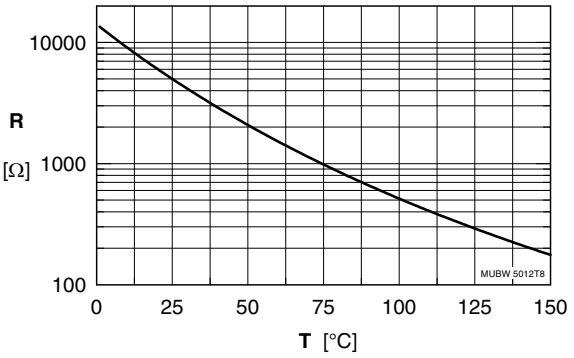


Fig. 15 Typ. termistor resistance versus temperature