# IXYS

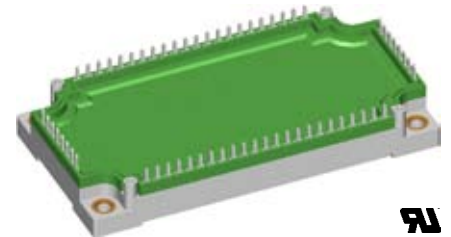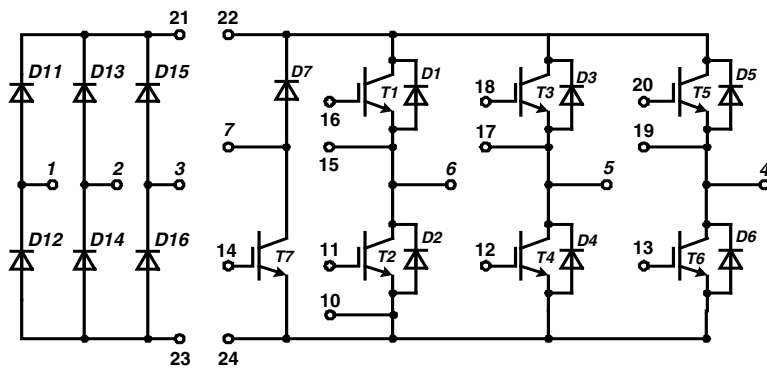## Converter - Brake - Inverter Module
## XPT IGBT

| Single Phase Rectifier | Brake Chopper | Three Phase Inverter |
|---|---|---|
| $V_{RRM}$ = 1600 V | $V_{CES}$ = 1200 V | $V_{CES}$ = 1200 V |
| $I_{DAVM25}$ = 390 A | $I_{C25}$ = 60 A | $I_{C25}$ = 120 A |
| $I_{FSM}$ = 1100 A | $V_{CE(sat)}$ = 1.8 V | $V_{CE(sat)}$ = 1.8 V |

**Part name** (Marking on product)

MIXA80WB1200TEH



Pin configuration see outlines.

**Features:**

- Easy paralleling due to the positive temperature coefficient of the on-state voltage
- Rugged XPT design (Xtreme light Punch Through) results in:
  - short circuit rated for 10 µsec.
  - very low gate charge
  - square RBSOA @ 3x $I_C$
  - low EMI
- Thin wafer technology combined with the XPT design results in a competitive low $V_{CE(sat)}$
- SONIC™ diode
  - fast and soft reverse recovery
  - low operating forward voltage

**Application:**

- AC motor drives
- Solar inverter
- Medical equipment
- Uninterruptible power supply
- Air-conditioning systems
- Welding equipment
- Switched-mode and resonant-mode power supplies

**Package:**

- "E3-Pack" standard outline
- Insulated copper base plate
- Soldering pins for PCB mounting
- Temperature sense included

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

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**Ouput Inverter T1 - T6**

| Symbol | Definitions | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| | | | **Ratings** | | | | |
| $V_{CES}$ | collector emitter voltage | $T_{VJ}$ = 25°C | | | | 1200 | V |
| $V_{GES}$ | max. DC gate voltage | continuous | | | | ±20 | V |
| $V_{GEM}$ | max. transient collector gate voltage | transient | | | | ±30 | V |
| $I_{C25}$ | collector current | $T_C$ = 25°C | | | | 120 | A |
| $I_{C80}$ | | $T_C$ = 80°C | | | | 84 | A |
| $P_{tot}$ | total power dissipation | $T_C$ = 25°C | | | | 390 | W |
| $V_{CE(sat)}$ | collector emitter saturation voltage | $I_C$ = 77 A; $V_{GE}$ = 15 V | $T_{VJ}$ = 25°C | | 1.8 | 2.1 | V |
| | | | $T_{VJ}$ = 125°C | | 2.1 | | V |
| $V_{GE(th)}$ | gate emitter threshold voltage | $I_C$ = 3 mA; $V_{GE}$ = $V_{CE}$ | $T_{VJ}$ = 25°C | 5.5 | 6.0 | 6.5 | V |
| $I_{CES}$ | collector emitter leakage current | $V_{CE}$ = $V_{CES}$; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | 0.03 | 0.2 | mA |
| | | | $T_{VJ}$ = 125°C | | 0.6 | | 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; $I_C$ = 75 A | | | 230 | | nC |
| $t_{d(on)}$ | turn-on delay time | | | | 70 | | ns |
| $t_r$ | current rise time | inductive load | $T_{VJ}$ = 125°C | | 40 | | ns |
| $t_{d(off)}$ | turn-off delay time | $V_{CE}$ = 600 V; $I_C$ = 75 A | | | 250 | | ns |
| $t_f$ | current fall time | $V_{GE}$ = ±15 V; $R_G$ = 10 Ω | | | 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 | $V_{GE}$ = ±15 V; $R_G$ = 10 Ω; | $T_{VJ}$ = 125°C | | | 225 | A |
| | | | $V_{CEK}$ = 1200 V | | | | |
| SCSOA | short circuit safe operating area | | | | | | |
| $t_{SC}$ | short circuit duration | $V_{CE}$ = 900 V; $V_{GE}$ = ±15 V; | $T_{VJ}$ = 125°C | | | 10 | µs |
| $I_{SC}$ | short circuit current | $R_G$ = 10 Ω; non-repetitive | | | 300 | | A |
| $R_{thJC}$ | thermal resistance junction to case | (per IGBT) | | | | 0.32 | K/W |

**Output Inverter D1 - D6**

| Symbol | Definitions | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| | | | **Ratings** | | | | |
| $V_{RRM}$ | max. repetitve reverse voltage | $T_{VJ}$ = 25°C | | | | 1200 | V |
| $I_{F25}$ | forward current | $T_C$ = 25°C | | | | 135 | A |
| $I_{F80}$ | | $T_C$ = 80°C | | | | 90 | A |
| $V_F$ | forward voltage | $I_F$ = 100 A; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | 1.95 | 2.2 | V |
| | | | $T_{VJ}$ = 125°C | | 1.85 | | V |
| $Q_{rr}$ | reverse recovery charge | $V_R$ = 600 V | | | - | | µC |
| $I_{RM}$ | max. reverse recovery current | $di_F$/dt = -1200 A/µs | $T_{VJ}$ = 125°C | | - | | A |
| $t_{rr}$ | reverse recovery time | $I_F$ = 100 A; $V_{GE}$ = 0 V | | | - | | ns |
| $E_{rec}$ | reverse recovery energy | | | | - | | mJ |
| $R_{thJC}$ | thermal resistance junction to case | (per diode) | | | | 0.4 | K/W |

$T_C$ = 25°C unless otherwise stated

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## Brake T7

| Symbol | Definitions | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CES}$ | collector emitter voltage | | $T_{VJ} = 25°C$ | | | 1200 | V |
| $V_{GES}$ | max. DC gate voltage | continuous | | | | ±20 | V |
| $V_{GEM}$ | max. transient collector gate voltage | transient | | | | ±30 | V |
| $I_{C25}$ | collector current | | $T_C = 25°C$ | | | 60 | A |
| $I_{C80}$ | | | $T_C = 80°C$ | | | 40 | A |
| $P_{tot}$ | total power dissipation | | $T_C = 25°C$ | | | 195 | W |
| $V_{CE(sat)}$ | collector emitter saturation voltage | $I_C = 35\ A;\ V_{GE} = 15\ V$ | $T_{VJ} = 25°C$ | | 1.8 | 2.1 | V |
| | | | $T_{VJ} = 125°C$ | | 2.1 | | V |
| $V_{GE(th)}$ | gate emitter threshold voltage | $I_C = 1.5\ mA;\ V_{GE} = V_{CE}$ | $T_{VJ} = 25°C$ | 5.5 | 6.0 | 6.5 | V |
| $I_{CES}$ | collector emitter leakage current | $V_{CE} = V_{CES};\ V_{GE} = 0\ V$ | $T_{VJ} = 25°C$ | | 0.01 | 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 | $V_{CE} = 600\ V;\ V_{GE} = 15\ V;\ I_C = 35\ A$ | | | 107 | | nC |
| $t_{d(on)}$ | turn-on delay time | | | | 70 | | ns |
| $t_r$ | current rise time | | | | 40 | | ns |
| $t_{d(off)}$ | turn-off delay time | inductive load | $T_{VJ} = 125°C$ | | 250 | | ns |
| $t_f$ | current fall time | $V_{CE} = 600\ V;\ I_C = 35\ A$ | | | 100 | | ns |
| $E_{on}$ | turn-on energy per pulse | $V_{GE} = ±15\ V;\ R_G = 27\ \Omega$ | | | 3.8 | | mJ |
| $E_{off}$ | turn-off energy per pulse | | | | 4.1 | | mJ |
| RBSOA | reverse bias safe operating area | $V_{GE} = ±15\ V;\ R_G = 27\ \Omega;$ | $T_{VJ} = 125°C$ $V_{CEK} = 1200\ V$ | | | 105 | A |
| SCSOA | short circuit safe operating area | | | | | | |
| $t_{SC}$ | short circuit duration | $V_{CE} = 900\ V;\ V_{GE} = ±15\ V;$ | $T_{VJ} = 125°C$ | | | 10 | µs |
| $I_{SC}$ | short circuit current | $R_G = 27\ \Omega;\ non\text{-}repetitive$ | | | 140 | | A |
| $R_{thJC}$ | thermal resistance junction to case | (per IGBT) | | | | 0.64 | K/W |

## Brake Chopper D7

| Symbol | Definitions | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | max. repetitive reverse voltage | | $T_{VJ} = 25°C$ | | | 1200 | V |
| $I_{F25}$ | forward current | | $T_C = 25°C$ | | | 44 | A |
| $I_{F80}$ | | | $T_C = 80°C$ | | | 29 | A |
| $V_F$ | forward voltage | $I_F = 30\ A;\ V_{GE} = 0\ V$ | $T_{VJ} = 25°C$ | | 1.95 | 2.2 | V |
| | | | $T_{VJ} = 125°C$ | | 1.85 | | V |
| $I_R$ | reverse current | $V_R = V_{RRM}$ | $T_{VJ} = 25°C$ | | 0.01 | 0.1 | mA |
| | | | $T_{VJ} = 125°C$ | | 0.15 | | mA |
| $Q_{rr}$ | reverse recovery charge | $V_R = 600\ V$ | | | tbd | | µC |
| $I_{RM}$ | max. reverse recovery current | $di_F/dt = tbd\ A/µs$ | $T_{VJ} = 125°C$ | | tbd | | A |
| $t_{rr}$ | reverse recovery time | $I_F = 30\ A;\ V_{GE} = 0\ V$ | | | tbd | | ns |
| $E_{rec}$ | reverse recovery energy | | | | tbd | | µJ |
| $R_{thJC}$ | thermal resistance junction to case | (per diode) | | | | 1.2 | K/W |

$T_C = 25°C$ unless otherwise stated

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# MIXA80WB1200TEH

## Input Rectifier Bridge D11 - D16

| Symbol | Definitions | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | max. repetitive reverse voltage | | $T_{VJ} = 25°C$ | | | 1600 | V |
| $I_{FAV}$ | average forward current | sine 180° | $T_C = 80°C$ | | | 94 | A |
| $I_{DAVM}$ | max. average DC output current | rect.; d = $^1/_3$ | $T_C = 80°C$ | | | 265 | A |
| $I_{FSM}$ | max. forward surge current | t = 10 ms; sine 50 Hz | $T_{VJ} = 25°C$ | | | 1100 | A |
| | | | $T_{VJ} = 125°C$ | | | 970 | A |
| $I^2t$ | $I^2t$ value for fusing | t = 10 ms; sine 50 Hz | $T_{VJ} = 25°C$ | | | 6000 | $A^2s$ |
| | | | $T_{VJ} = 125°C$ | | | 4700 | $A^2s$ |
| $P_{tot}$ | total power dissipation | | $T_C = 25°C$ | | | 250 | W |
| $V_F$ | forward voltage | $I_F = 150$ A | $T_{VJ} = 25°C$ | | 1.3 | 1.6 | V |
| | | | $T_{VJ} = 125°C$ | | 1.3 | | V |
| $I_R$ | reverse current | $V_R = V_{RRM}$ | $T_{VJ} = 25°C$ | | 0.05 | 0.1 | mA |
| | | | $T_{VJ} = 125°C$ | | 2.0 | | mA |
| $R_{thJC}$ | thermal resistance junction to case | (per diode) | | | | 0.5 | K/W |

## Temperature Sensor NTC

| Symbol | Definitions | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $R_{25}$ | resistance | | $T_C = 25°C$ | 4.75 | 5.0 | 5.25 | kΩ |
| $B_{25/50}$ | | | | | 3375 | | K |

## Module

| Symbol | Definitions | Conditions | 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 | $I_{ISOL} \le 1$ mA; 50/60 Hz | | | 3000 | V~ |
| CTI | comparative tracking index | | | - | | |
| $M_d$ | mounting torque (M5) | | 3 | | 6 | Nm |
| $d_S$ | creep distance on surface | | 6 | | | mm |
| $d_A$ | strike distance through air | | 6 | | | mm |
| $R_{pin-chip}$ | resistance pin to chip | | | 5 | | mΩ |
| $R_{thCH}$ | thermal resistance case to heatsink | with heatsink compound | | 0.01 | | K/W |
| **Weight** | | | | 300 | | g |

## Equivalent Circuits for Simulation
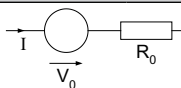


| Symbol | Definitions | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_0$ | rectifier diode | D8 - D13 | $T_{VJ} = 150°C$ | | | 0.87 | V |
| $R_0$ | | | | | | 2.7 | mΩ |
| $V_0$ | IGBT | T1 - T6 | $T_{VJ} = 150°C$ | | | 1.1 | V |
| $R_0$ | | | | | | 17.9 | mΩ |
| $V_0$ | free wheeling diode | D1 - D6 | $T_{VJ} = 150°C$ | | | 1.09 | V |
| $R_0$ | | | | | | 9.1 | mΩ |
| $V_0$ | IGBT | T7 | $T_{VJ} = 150°C$ | | | 1.1 | V |
| $R_0$ | | | | | | 40 | mΩ |
| $V_0$ | free wheeling diode | D7 | $T_{VJ} = 150°C$ | | | 1.2 | V |
| $R_0$ | | | | | | 27.0 | mΩ |

$T_C = 25°C$ unless otherwise stated

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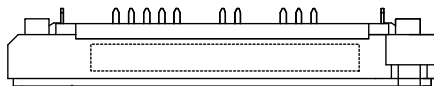20090901b

# MIXA80WB1200TEH

## Circuit Diagram



## Outline Drawing

Dimensions in mm (1 mm = 0.0394")
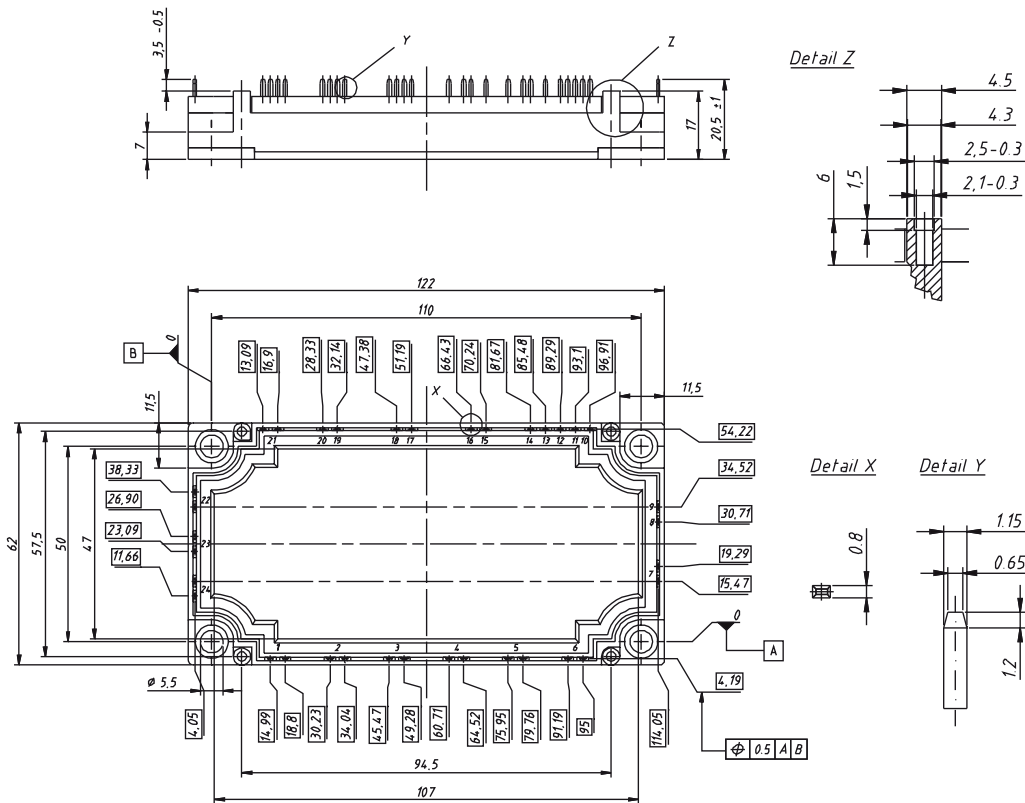


## Product Marking



**Part number**

M = Module
I = IGBT
XA = XPT standard
80 = Current Rating [A]
WB = 6-Pack + 3~ Rectifier Bridge & Brake Unit
1200 = Reverse Voltage [V]
T = NTC
EH = E3-Pack

| Ordering | Part Name | Marking on Product | Delivering Mode | Base Qty | Ordering Code |
|----------|-----------|--------------------|-----------------|----------|---------------|
| Standard | MIXA80WB1200 TEH | MIXA80WB1200TEH | Box | 6 | 509112 |

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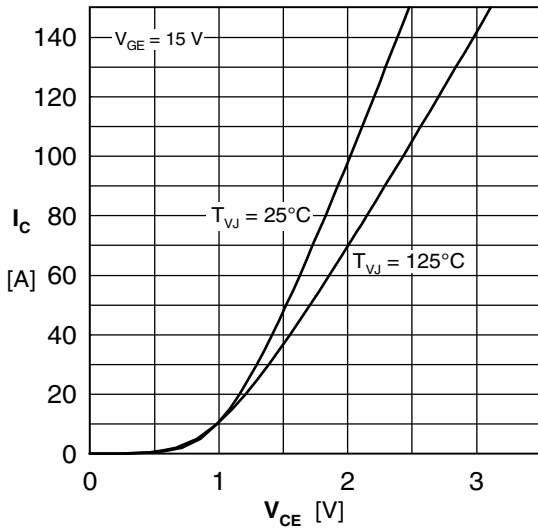
Fig. 1 Typ. output characteristics
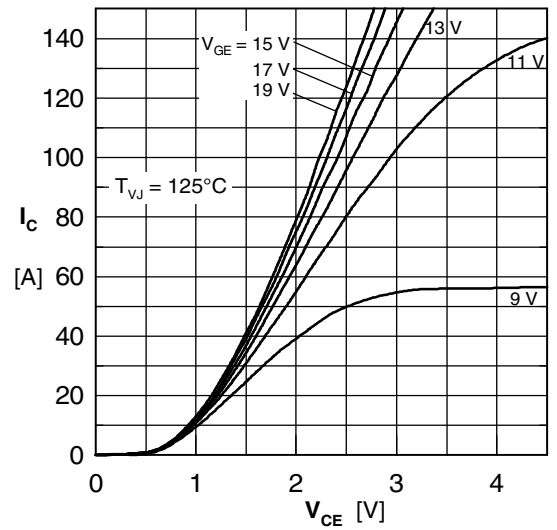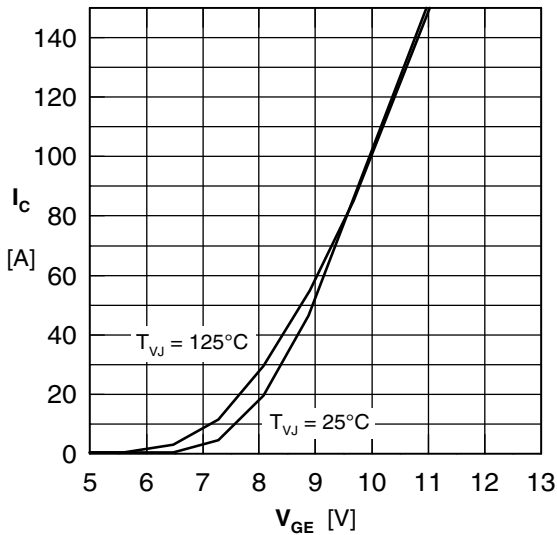


Fig. 2 Typ. output characteristics
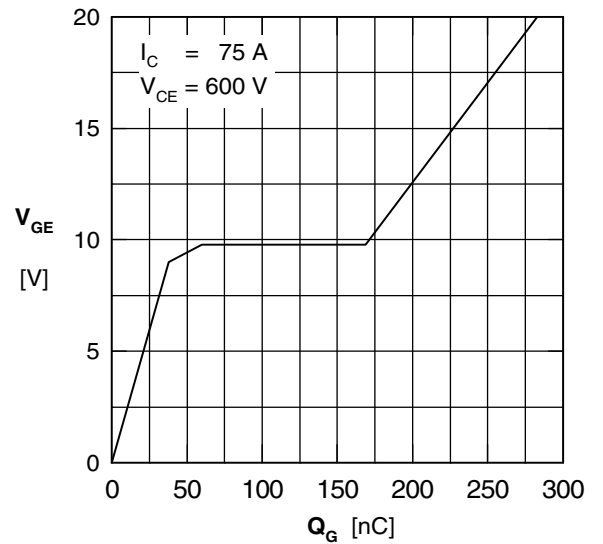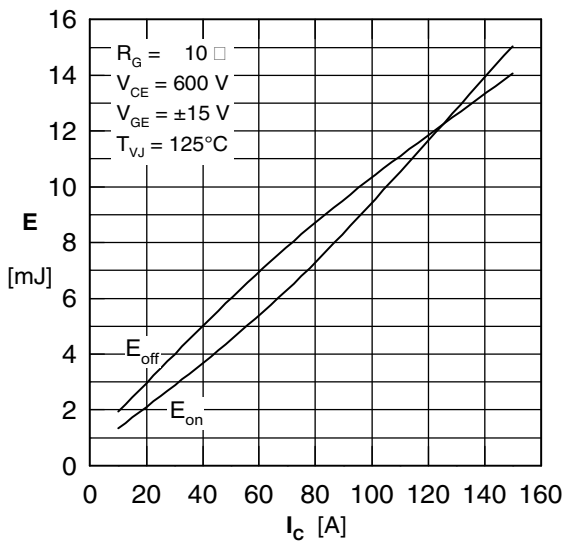


Fig. 3 Typ. tranfer characteristics



Fig. 4  Typ. turn-on gate charge



Fig. 5 Typ. switching energy vs. collector current



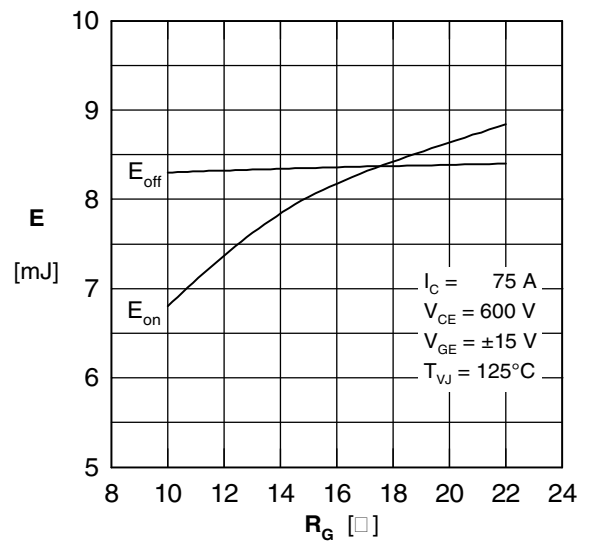Fig. 6 Typ. switching energy vs. gate resistance

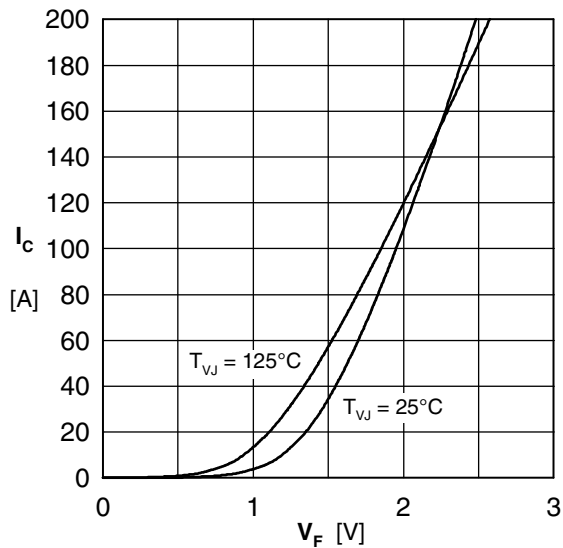IXYS reserves the right to change limits, test conditions and dimensions.

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Fig. 7 Typ. forward characteristic
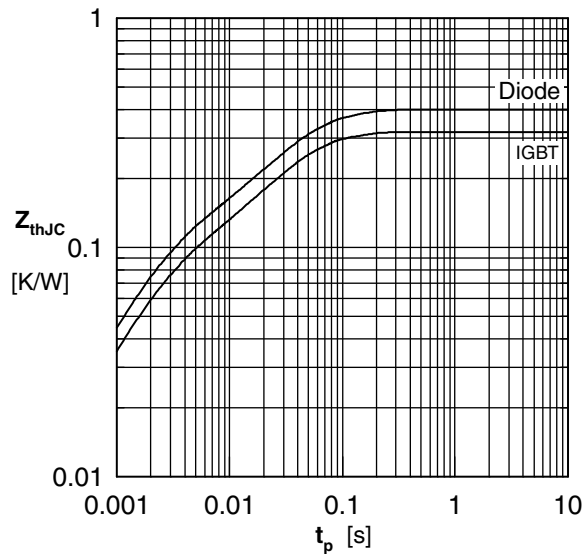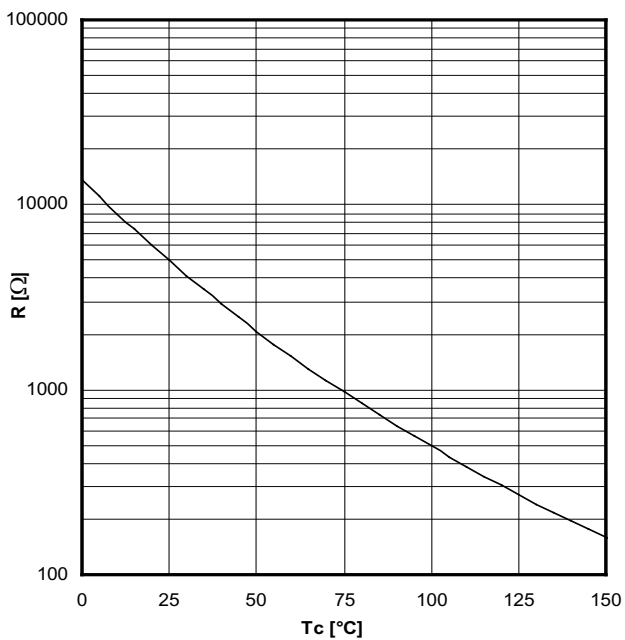


Fig. 8 Typ. transient thermal impedance

| | IGBT | | FRD | |
|---|---|---|---|---|
| | $R_i$ | $\tau_i$ | $R_i$ | $\tau_i$ |
| 1 | 0.072 | 0.002 | 0.092 | 0.002 |
| 2 | 0.037 | 0.03 | 0.067 | 0.03 |
| 3 | 0.156 | 0.03 | 0.155 | 0.03 |
| 4 | 0.055 | 0.08 | 0.086 | 0.08 |

**NTC**



Typ. NTC resistance versus temperature

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