

# Six-Pack XPT IGBT

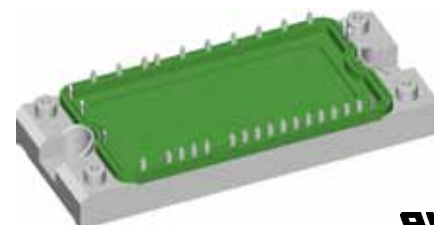
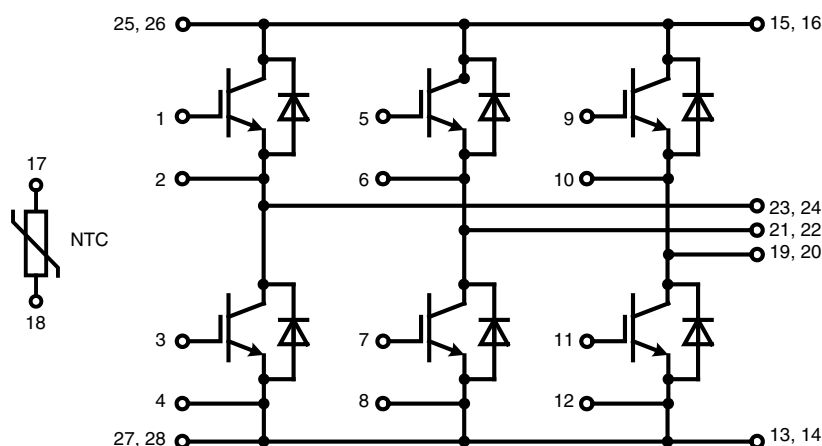
$$V_{CES} = 1200 \text{ V}$$

$$I_{C25} = 60 \text{ A}$$

$$V_{CE(sat)} = 1.8 \text{ V}$$

**Part name** (Marking on product)

MIXA40W1200TED



  
E 72873

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  $\mu$ sec.
  - very low gate charge
  - square RBSOA @  $3 \times I_C$
  - 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:

- "E2-Pack" standard outline
- Insulated copper base plate
- Soldering pins for PCB mounting
- Temperature sense included

**Output Inverter T1 - T6**

|               |                                       |                                                                                                              |                                                                 | Ratings    |          |               |   |
|---------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------|----------|---------------|---|
| Symbol        | Definitions                           | Conditions                                                                                                   | min.                                                            | typ.       | max.     | Unit          |   |
| $V_{CES}$     | collector emitter voltage             | $T_{VJ} = 25^{\circ}\text{C}$                                                                                |                                                                 |            | 1200     | V             |   |
| $V_{GES}$     | max. DC gate voltage                  | continuous                                                                                                   |                                                                 |            | $\pm 20$ | V             |   |
| $V_{GEM}$     | max. transient collector gate voltage | transient                                                                                                    |                                                                 |            | $\pm 30$ | V             |   |
| $I_{C25}$     | collector current                     | $T_C = 25^{\circ}\text{C}$                                                                                   |                                                                 |            | 60       | A             |   |
| $I_{C80}$     |                                       | $T_C = 80^{\circ}\text{C}$                                                                                   |                                                                 |            | 40       | A             |   |
| $P_{tot}$     | total power dissipation               | $T_C = 25^{\circ}\text{C}$                                                                                   |                                                                 |            | 195      | W             |   |
| $V_{CE(sat)}$ | collector emitter saturation voltage  | $I_C = 35\text{ A}; V_{GE} = 15\text{ V}$                                                                    | $T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$ | 1.8<br>2.1 | 2.1      | V<br>V        |   |
| $V_{GE(th)}$  | gate emitter threshold voltage        | $I_C = 1.5\text{ mA}; V_{GE} = V_{CE}$                                                                       | $T_{VJ} = 25^{\circ}\text{C}$                                   | 5.4        | 6.0      | 6.5           | V |
| $I_{CES}$     | collector emitter leakage current     | $V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$                                                                      | $T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$ |            | 2.1      | mA<br>mA      |   |
| $I_{GES}$     | gate emitter leakage current          | $V_{GE} = \pm 20\text{ V}$                                                                                   |                                                                 |            | 500      | nA            |   |
| $Q_{G(on)}$   | total gate charge                     | $V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 35\text{ A}$                                             |                                                                 | 106        |          | nC            |   |
| $t_{d(on)}$   | turn-on delay time                    | inductive load<br>$V_{CE} = 600\text{ V}; I_C = 35\text{ A}$<br>$V_{GE} = \pm 15\text{ V}; R_G = 27\ \Omega$ | $T_{VJ} = 125^{\circ}\text{C}$                                  | 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              |                                                                                                              |                                                                 | 3.8        |          | mJ            |   |
| $E_{off}$     | turn-off energy per pulse             |                                                                                                              |                                                                 | 4.1        |          | mJ            |   |
| <b>RBSOA</b>  | reverse bias safe operating area      | $V_{GE} = \pm 15\text{ V}; R_G = 27\ \Omega;$                                                                | $T_{VJ} = 125^{\circ}\text{C}$<br>$V_{CEK} = 1200\text{ V}$     |            | 105      | A             |   |
| <b>SCSOA</b>  | short circuit safe operating area     |                                                                                                              |                                                                 |            |          |               |   |
| $t_{sc}$      | short circuit duration                | $V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V};$                                                           | $T_{VJ} = 125^{\circ}\text{C}$                                  |            | 10       | $\mu\text{s}$ |   |
| $I_{sc}$      | short circuit current                 | $R_G = 27\ \Omega;$ non-repetitive                                                                           |                                                                 | 140        |          | A             |   |
| $R_{thJC}$    | thermal resistance junction to case   | (per IGBT)                                                                                                   |                                                                 |            | 0.64     | K/W           |   |

**Output Inverter D1 - D6**

|            |                                     |                                                                                                           |                                                                 | Ratings      |      |               |
|------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|--------------|------|---------------|
| Symbol     | Definitions                         | Conditions                                                                                                | min.                                                            | typ.         | max. | Unit          |
| $V_{RRM}$  | max. repetitive reverse voltage     | $T_{VJ} = 25^{\circ}\text{C}$                                                                             |                                                                 |              | 1200 | V             |
| $I_{F25}$  | forward current                     | $T_C = 25^{\circ}\text{C}$                                                                                |                                                                 |              | 44   | A             |
| $I_{F80}$  |                                     | $T_C = 80^{\circ}\text{C}$                                                                                |                                                                 |              | 29   | A             |
| $V_F$      | forward voltage                     | $I_F = 30\text{ A}; V_{GE} = 0\text{ V}$                                                                  | $T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$ | 1.95<br>1.95 | 2.2  | V<br>V        |
| $Q_{rr}$   | reverse recovery charge             | $V_R = 600\text{ V}$<br>$di_F/dt = -600\text{ A}/\mu\text{s}$<br>$I_F = 30\text{ A}; V_{GE} = 0\text{ V}$ | $T_{VJ} = 125^{\circ}\text{C}$                                  | 3.5          |      | $\mu\text{C}$ |
| $I_{RM}$   | max. reverse recovery current       |                                                                                                           |                                                                 | 30           |      | A             |
| $t_{rr}$   | reverse recovery time               |                                                                                                           |                                                                 | 350          |      | ns            |
| $E_{rec}$  | reverse recovery energy             |                                                                                                           |                                                                 | 0.9          |      | mJ            |
| $R_{thJC}$ | thermal resistance junction to case | (per diode)                                                                                               |                                                                 |              | 1.2  | K/W           |

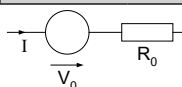
 $T_C = 25^{\circ}\text{C}$  unless otherwise stated

**Temperature Sensor NTC**

| Symbol      | Definitions | Conditions                 | min. | Ratings |      |  | Unit       |
|-------------|-------------|----------------------------|------|---------|------|--|------------|
|             |             |                            |      | typ.    | max. |  |            |
| $R_{25}$    | resistance  | $T_C = 25^{\circ}\text{C}$ | 4.75 | 5.0     | 5.25 |  | k $\Omega$ |
| $B_{25/50}$ |             |                            |      | 3375    |      |  | K          |

**Module**

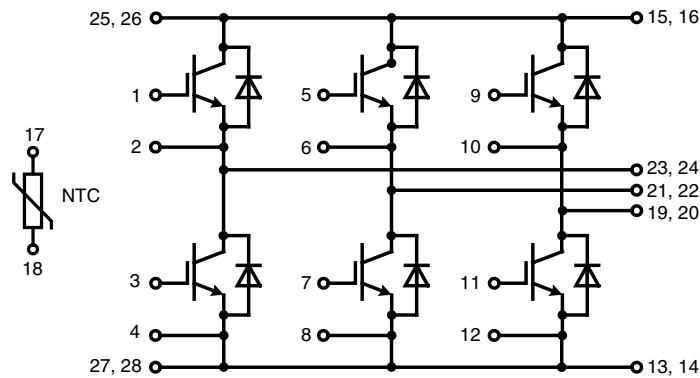
| Symbol         | Definitions                         | Conditions                                     | min. | Ratings |      |  | Unit               |
|----------------|-------------------------------------|------------------------------------------------|------|---------|------|--|--------------------|
|                |                                     |                                                |      | typ.    | max. |  |                    |
| $T_{VJ}$       | operating temperature               |                                                | -40  |         | 125  |  | $^{\circ}\text{C}$ |
| $T_{VJM}$      | max. virtual junction temperature   |                                                |      |         | 150  |  | $^{\circ}\text{C}$ |
| $T_{stg}$      | storage temperature                 |                                                | -40  |         | 125  |  | $^{\circ}\text{C}$ |
| $V_{ISOL}$     | isolation voltage                   | $I_{ISOL} \leq 1 \text{ mA}; 50/60 \text{ Hz}$ |      |         | 2500 |  | V~                 |
| CTI            | comparative tracking index          |                                                |      |         | -    |  |                    |
| $M_d$          | mounting torque (M5)                |                                                | 3    |         | 6    |  | Nm                 |
| $d_s$          | creep distance on surface           |                                                | 10   |         |      |  | mm                 |
| $d_A$          | strike distance through air         |                                                | 7.5  |         |      |  | mm                 |
| $R_{pin-chip}$ | resistance pin to chip              |                                                |      | 2.5     |      |  | m $\Omega$         |
| $R_{thCH}$     | thermal resistance case to heatsink | with heatsink compound                         |      | 0.02    |      |  | K/W                |
| Weight         |                                     |                                                |      | 180     |      |  | g                  |

**Equivalent Circuits for Simulation**


| Symbol | Definitions         | Conditions | min.                           | Ratings |      |  | Unit       |
|--------|---------------------|------------|--------------------------------|---------|------|--|------------|
|        |                     |            |                                | typ.    | max. |  |            |
| $V_0$  | IGBT                | T1 - T6    | $T_{VJ} = 150^{\circ}\text{C}$ |         | 1.1  |  | V          |
| $R_0$  |                     |            |                                |         | 40   |  | m $\Omega$ |
| $V_0$  | free wheeling diode | D1 - D6    | $T_{VJ} = 150^{\circ}\text{C}$ |         | 1.2  |  | V          |
| $R_0$  |                     |            |                                |         | 27   |  | m $\Omega$ |

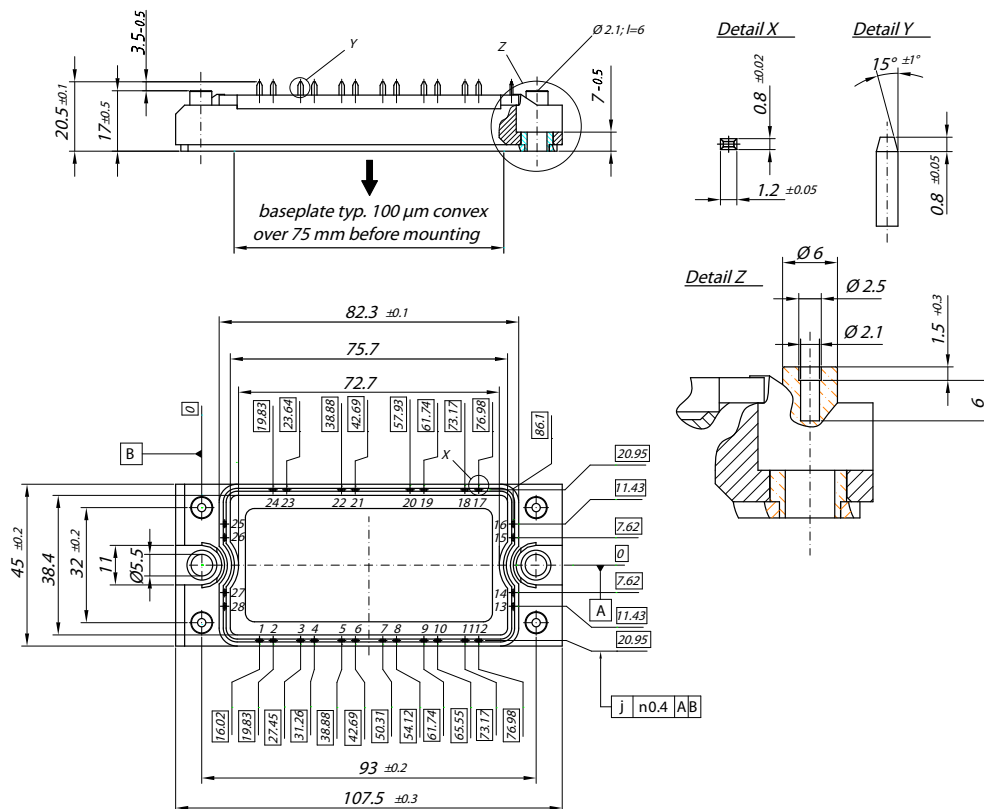
$T_C = 25^{\circ}\text{C}$  unless otherwise stated

## Circuit Diagram

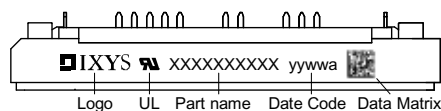


## Outline Drawing

Dimensions in mm (1 mm = 0.0394")



## Product Marking



### Part number

M = Module  
I = IGBT  
X = XPT  
A = Standard  
40 = Current Rating [A]  
W = Six-Pack  
1200 = Reverse Voltage [V]  
T = NTC  
ED = E2-Pack

| Ordering | Part Name       | Marking on Product | Delivering Mode | Base Qty | Ordering Code |
|----------|-----------------|--------------------|-----------------|----------|---------------|
| Standard | MIXA40W1200 TED | MIXA40W1200TED     | Box             | 6        | 507667        |

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

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## Inverter T1 - T6

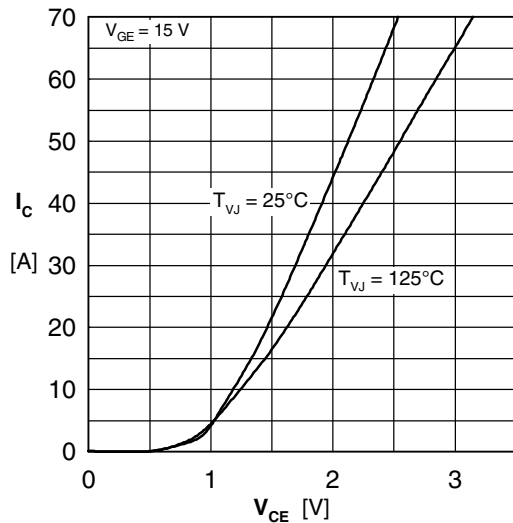


Fig. 1 Typ. output characteristics

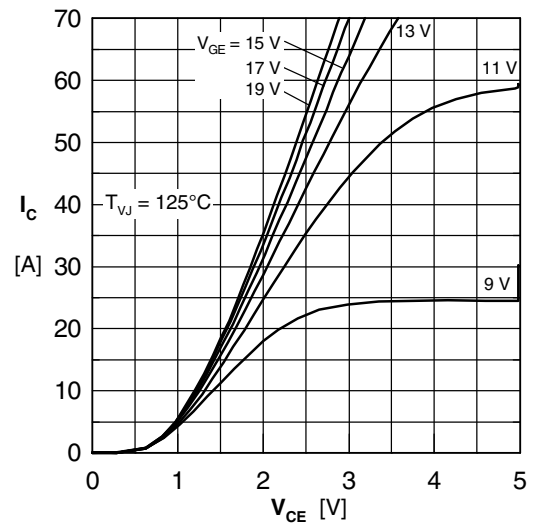


Fig. 2 Typ. output characteristics

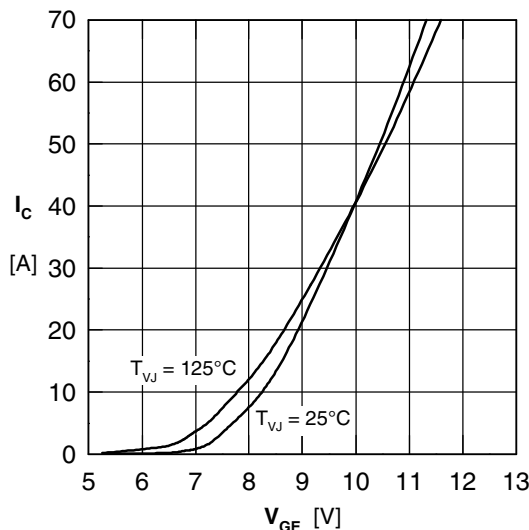


Fig. 3 Typ. transfer characteristics

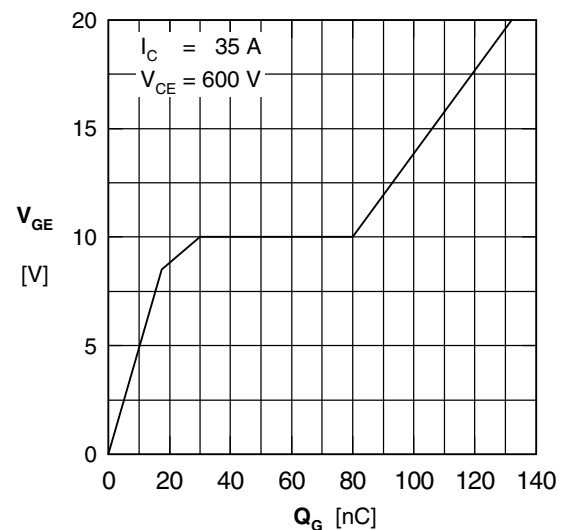


Fig. 4 Typ. turn-on gate charge

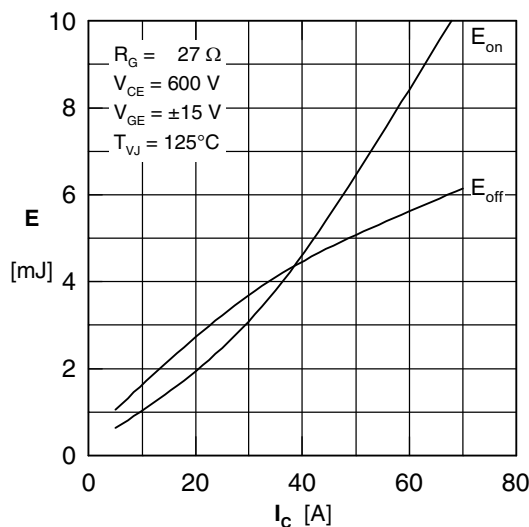


Fig. 5 Typ. switching energy vs. collector current

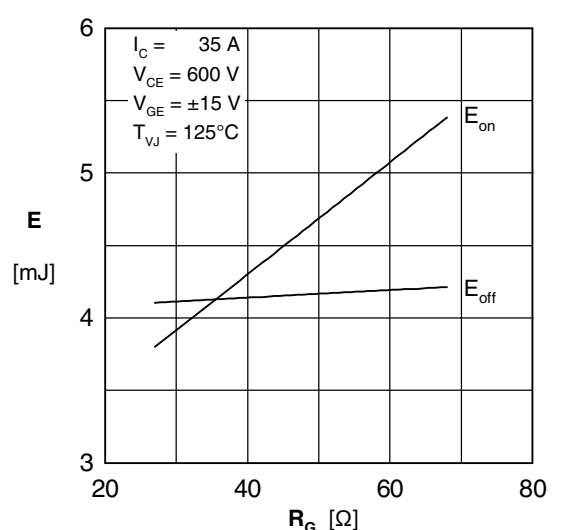


Fig. 6 Typ. switching energy vs. gate resistance

## Inverter D1 - D6

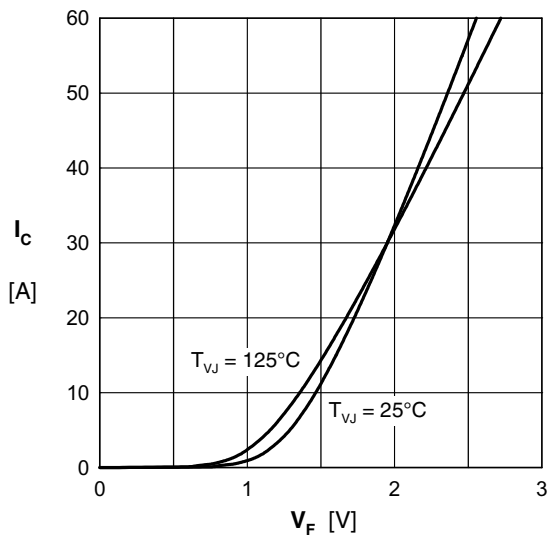


Fig. 7 Typ. forward characteristic

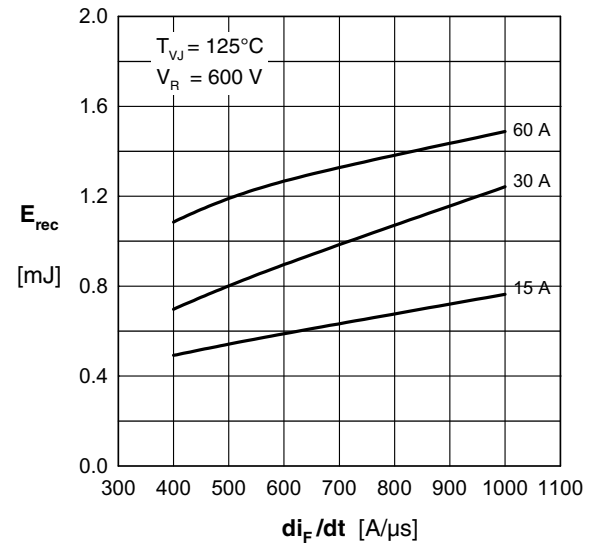


Fig. 8 Typ. recovery energy  $E_{rec}$  versus  $di/dt$

## NTC

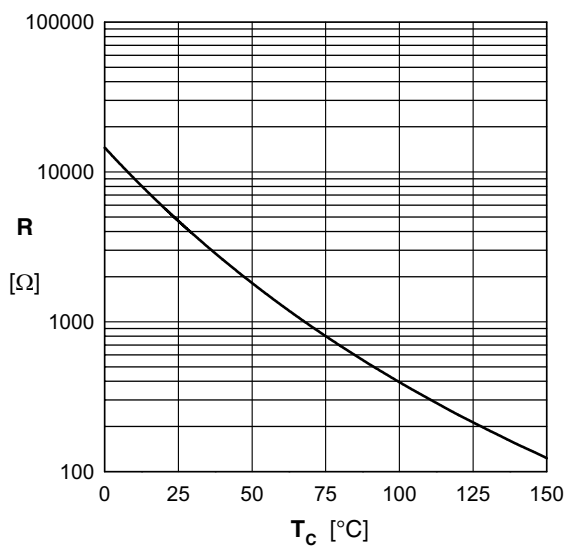


Fig. 9 Typ. NTC resistance versus temperature

|   | IGBT  |          | FRD   |          |
|---|-------|----------|-------|----------|
|   | $R_i$ | $\tau_i$ | $R_i$ | $\tau_i$ |
| 1 | 0.152 | 0.0025   | 0.341 | 0.0025   |
| 2 | 0.072 | 0.03     | 0.217 | 0.03     |
| 3 | 0.308 | 0.03     | 0.348 | 0.03     |
| 4 | 0.108 | 0.08     | 0.294 | 0.08     |

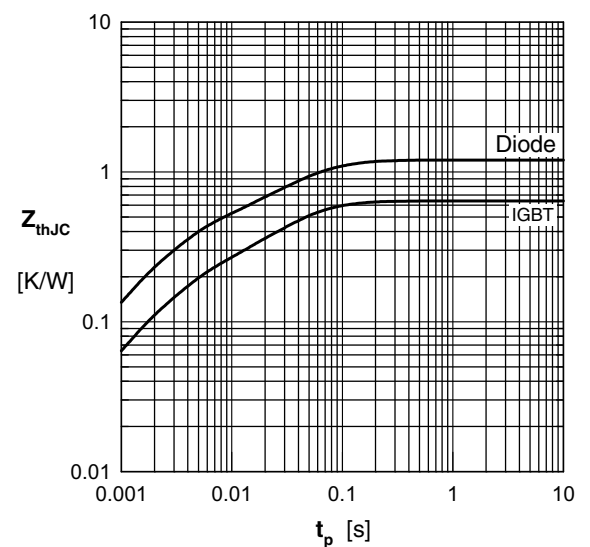


Fig. 10 Typ. transient thermal impedance