

## XPT IGBT Module

$$V_{CES} = 2 \times 1200 \text{ V}$$

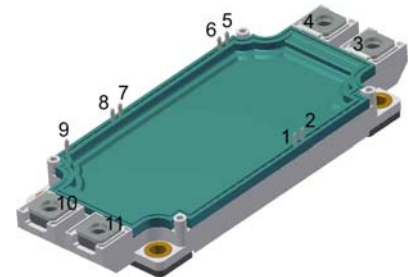
$$I_{C25} = 650 \text{ A}$$

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

Phase leg + free wheeling Diodes + NTC

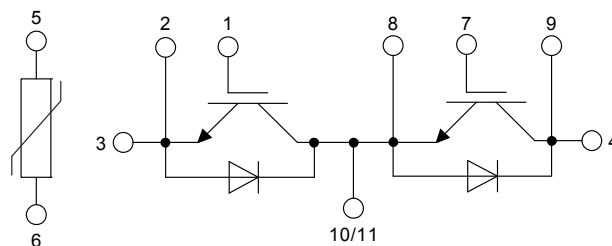
Part number

**MIXA450PF1200TSF**



Backside: isolated

 E72873



### Features / Advantages:

- High level of integration - only one power semiconductor module required for the whole drive
- Rugged XPT design (Xtreme light Punch Through) results in:
  - short circuit rated for 10  $\mu$ sec.
  - very low gate charge
  - low EMI
  - square RBSOA @ 3x  $I_c$
- Thin wafer technology combined with the XPT design results in a competitive low  $V_{CE(sat)}$
- Temperature sense included
- SONIC™ diode
  - fast and soft reverse recovery
  - low operating forward voltage

### Applications:

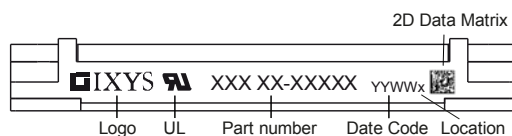
- AC motor drives
- Pumps, Fans
- Air-conditioning system
- Inverter and power supplies
- UPS

### Package: SimBus F

- Isolation Voltage: 3000V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Height: 17 mm
- Base plate: Copper internally DCB isolated
- Advanced power cycling

| IGBT                 |                                        |                                                                                                                      |                         | Ratings |      |       |      |
|----------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------|---------|------|-------|------|
| Symbol               | Definition                             | Conditions                                                                                                           |                         | min.    | typ. | max.  | Unit |
| V <sub>CES</sub>     | collector emitter voltage              | T <sub>VJ</sub> = 25°C                                                                                               |                         |         |      | 1200  | V    |
| V <sub>GES</sub>     | max. DC gate voltage                   |                                                                                                                      |                         |         |      | ±20   | V    |
| V <sub>GEM</sub>     | max. transient gate emitter voltage    |                                                                                                                      |                         |         |      | ±30   | V    |
| I <sub>C25</sub>     | collector current                      | T <sub>C</sub> = 25°C                                                                                                |                         |         |      | 650   | A    |
| I <sub>C80</sub>     |                                        | T <sub>C</sub> = 80°C                                                                                                |                         |         |      | 450   | A    |
| P <sub>tot</sub>     | total power dissipation                | T <sub>C</sub> = 25°C                                                                                                |                         |         |      | 2100  | W    |
| V <sub>CE(sat)</sub> | collector emitter saturation voltage   | I <sub>C</sub> = 450A; V <sub>GE</sub> = 15 V                                                                        | T <sub>VJ</sub> = 25°C  |         | 1.8  | 2.15  | V    |
|                      |                                        |                                                                                                                      | T <sub>VJ</sub> = 125°C |         | 2.15 |       | V    |
| V <sub>GE(th)</sub>  | gate emitter threshold voltage         | I <sub>C</sub> = 18mA; V <sub>GE</sub> = V <sub>CE</sub>                                                             | T <sub>VJ</sub> = 25°C  | 5.4     | 5.9  | 6.5   | V    |
| I <sub>CES</sub>     | collector emitter leakage current      | V <sub>CE</sub> = V <sub>CES</sub> ; V <sub>GE</sub> = 0 V                                                           | T <sub>VJ</sub> = 25°C  |         |      | 1     | mA   |
|                      |                                        |                                                                                                                      | T <sub>VJ</sub> = 125°C |         | 6    |       | mA   |
| I <sub>GES</sub>     | gate emitter leakage current           | V <sub>GE</sub> = ±20 V                                                                                              |                         |         |      | 1.5   | µA   |
| Q <sub>G(on)</sub>   | total gate charge                      | V <sub>CE</sub> = 600 V; V <sub>GE</sub> = 15 V; I <sub>C</sub> = 450 A                                              |                         |         | 1400 |       | nC   |
| t <sub>d(on)</sub>   | turn-on delay time                     | inductive load<br>V <sub>CE</sub> = 600 V; I <sub>C</sub> = 450 A<br>V <sub>GE</sub> = ±15 V; R <sub>G</sub> = 1.6 Ω | T <sub>VJ</sub> = 125°C |         | 85   |       | ns   |
| t <sub>r</sub>       | current rise time                      |                                                                                                                      |                         |         | 80   |       | ns   |
| t <sub>d(off)</sub>  | turn-off delay time                    |                                                                                                                      |                         |         | 310  |       | ns   |
| t <sub>f</sub>       | current fall time                      |                                                                                                                      |                         |         | 360  |       | ns   |
| E <sub>on</sub>      | turn-on energy per pulse               |                                                                                                                      |                         |         | 22   |       | mJ   |
| E <sub>off</sub>     | turn-off energy per pulse              |                                                                                                                      |                         |         | 68   |       | mJ   |
| RBSOA                | reverse bias safe operating area       | V <sub>GE</sub> = ±15 V; R <sub>G</sub> = 1.6 Ω                                                                      | T <sub>VJ</sub> = 125°C |         |      |       |      |
| I <sub>CM</sub>      |                                        | V <sub>CEmax</sub> = 1200V                                                                                           |                         |         |      | 900   | A    |
| SCSOA                | short circuit safe operating area      | V <sub>CEmax</sub> = 1200 V                                                                                          |                         |         |      |       |      |
| t <sub>sc</sub>      | short circuit duration                 | V <sub>CE</sub> = 900 V; V <sub>GE</sub> = ±15 V                                                                     | T <sub>VJ</sub> = 125°C |         |      | 10    | µs   |
| I <sub>sc</sub>      | short circuit current                  | R <sub>G</sub> = 1.6 Ω; non-repetitive                                                                               |                         |         | 1900 |       | A    |
| R <sub>thJC</sub>    | thermal resistance junction to case    |                                                                                                                      |                         |         |      | 0.06  | K/W  |
| R <sub>thCH</sub>    | thermal resistance case to heatsink    |                                                                                                                      |                         |         | 0.03 |       | K/W  |
|                      |                                        |                                                                                                                      |                         |         |      |       |      |
| Diode                |                                        |                                                                                                                      |                         |         |      |       |      |
| V <sub>RRM</sub>     | max. repetitive reverse voltage        | T <sub>VJ</sub> = 25°C                                                                                               |                         |         |      | 1200  | V    |
| I <sub>F25</sub>     | forward current                        | T <sub>C</sub> = 25°C                                                                                                |                         |         |      | 380   | A    |
| I <sub>F80</sub>     |                                        | T <sub>C</sub> = 80°C                                                                                                |                         |         |      | 265   | A    |
| V <sub>F</sub>       | forward voltage                        | I <sub>F</sub> = 450A                                                                                                | T <sub>VJ</sub> = 25°C  |         |      | 2.30  | V    |
|                      |                                        |                                                                                                                      | T <sub>VJ</sub> = 125°C |         | 2.00 |       | V    |
| I <sub>R</sub>       | reverse current                        | V <sub>R</sub> = V <sub>RRM</sub>                                                                                    | T <sub>VJ</sub> = 25°C  |         |      | *     | mA   |
|                      | * not applicable, see Ices value above |                                                                                                                      | T <sub>VJ</sub> = 125°C |         | *    |       | mA   |
| Q <sub>rr</sub>      | reverse recovery charge                | V <sub>R</sub> = 600 V<br>-di <sub>F</sub> /dt = 5400 A/µs<br>I <sub>F</sub> = 450A; V <sub>GE</sub> = 0 V           | T <sub>VJ</sub> = 125°C |         | 62   |       | µC   |
| I <sub>RM</sub>      | max. reverse recovery current          |                                                                                                                      |                         |         | 425  |       | A    |
| t <sub>rr</sub>      | reverse recovery time                  |                                                                                                                      |                         |         | 360  |       | ns   |
| E <sub>rec</sub>     | reverse recovery energy                |                                                                                                                      |                         |         | 26   |       | mJ   |
| R <sub>thJC</sub>    | thermal resistance junction to case    |                                                                                                                      |                         |         |      | 0.095 | K/W  |
| R <sub>thCH</sub>    | thermal resistance case to heatsink    |                                                                                                                      |                         |         | 0.04 |       | K/W  |

| Package SimBus F |                                                              |                                                                             | Ratings |      |      |      |
|------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------|---------|------|------|------|
| Symbol           | Definition                                                   | Conditions                                                                  | min.    | typ. | max. | Unit |
| $I_{RMS}$        | RMS current                                                  | per terminal                                                                |         |      |      | A    |
| $T_{stg}$        | storage temperature                                          |                                                                             | -40     |      | 125  | °C   |
| $T_{VJ}$         | virtual junction temperature                                 |                                                                             | -40     |      | 150  | °C   |
| Weight           |                                                              |                                                                             |         | 350  |      | g    |
| $M_D$            | mounting torque                                              |                                                                             | 3       |      | 6    | Nm   |
| $M_T$            | terminal torque                                              |                                                                             | 3       |      | 6    | Nm   |
| $d_{Spp/App}$    | creepage distance on surface   striking distance through air | terminal to terminal                                                        | 12.7    |      |      | mm   |
| $d_{Spb/Apb}$    |                                                              | terminal to backside                                                        | 10.0    |      |      | mm   |
| $V_{ISOL}$       | isolation voltage                                            | t = 1 second                                                                | 3000    |      |      | V    |
|                  |                                                              | t = 1 minute                                                                | 2500    |      |      | V    |
| $R_{pin-chip}$   | resistance pin to chip                                       | $V = V_{CEsat} + 2 \cdot R \cdot I_C$ resp. $V = V_F + 2 \cdot R \cdot I_F$ |         | 0.65 |      | mΩ   |



## Part number

M = Module  
 I = IGBT  
 X = XPT IGBT  
 A = Gen 1 / std  
 450 = Current Rating [A]  
 PF = Phase leg + free wheeling Diodes  
 1200 = Reverse Voltage [V]  
 T = Thermistor \ Temperature sensor  
 SF = SimBus F

| Ordering | Part Number      | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|------------------|--------------------|---------------|----------|----------|
| Standard | MIXA450PF1200TSF | MIXA450PF1200TSF   | Box           | 3        | 511202   |

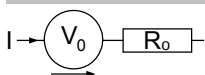
## Temperature Sensor NTC

| Symbol      | Definition              | Conditions          | min. | typ. | max. | Unit |
|-------------|-------------------------|---------------------|------|------|------|------|
| $R_{25}$    | resistance              | $T_{VJ} = 25^\circ$ | 4.75 | 5    | 5.25 | kΩ   |
| $B_{25/50}$ | temperature coefficient |                     |      | 3375 |      | K    |

## Equivalent Circuits for Simulation

\* on die level

$T_{VJ} = 150^\circ\text{C}$



$V_{0\max}$  threshold voltage

$R_{0\max}$  slope resistance \*

IGBT

Diode

1.1

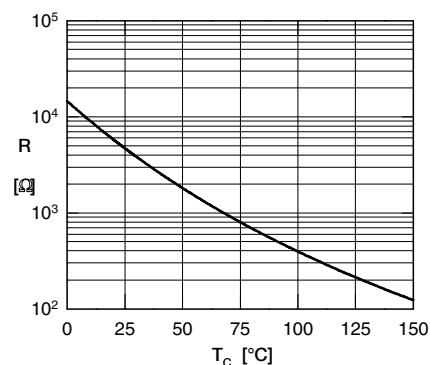
1.25

V

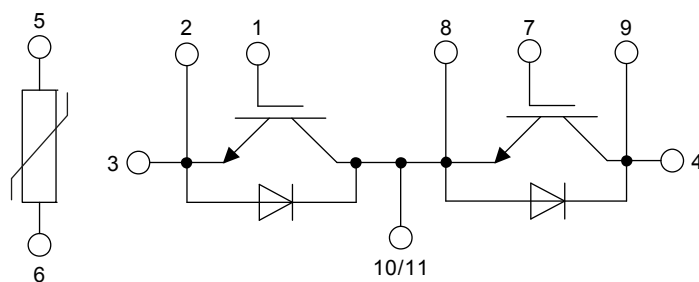
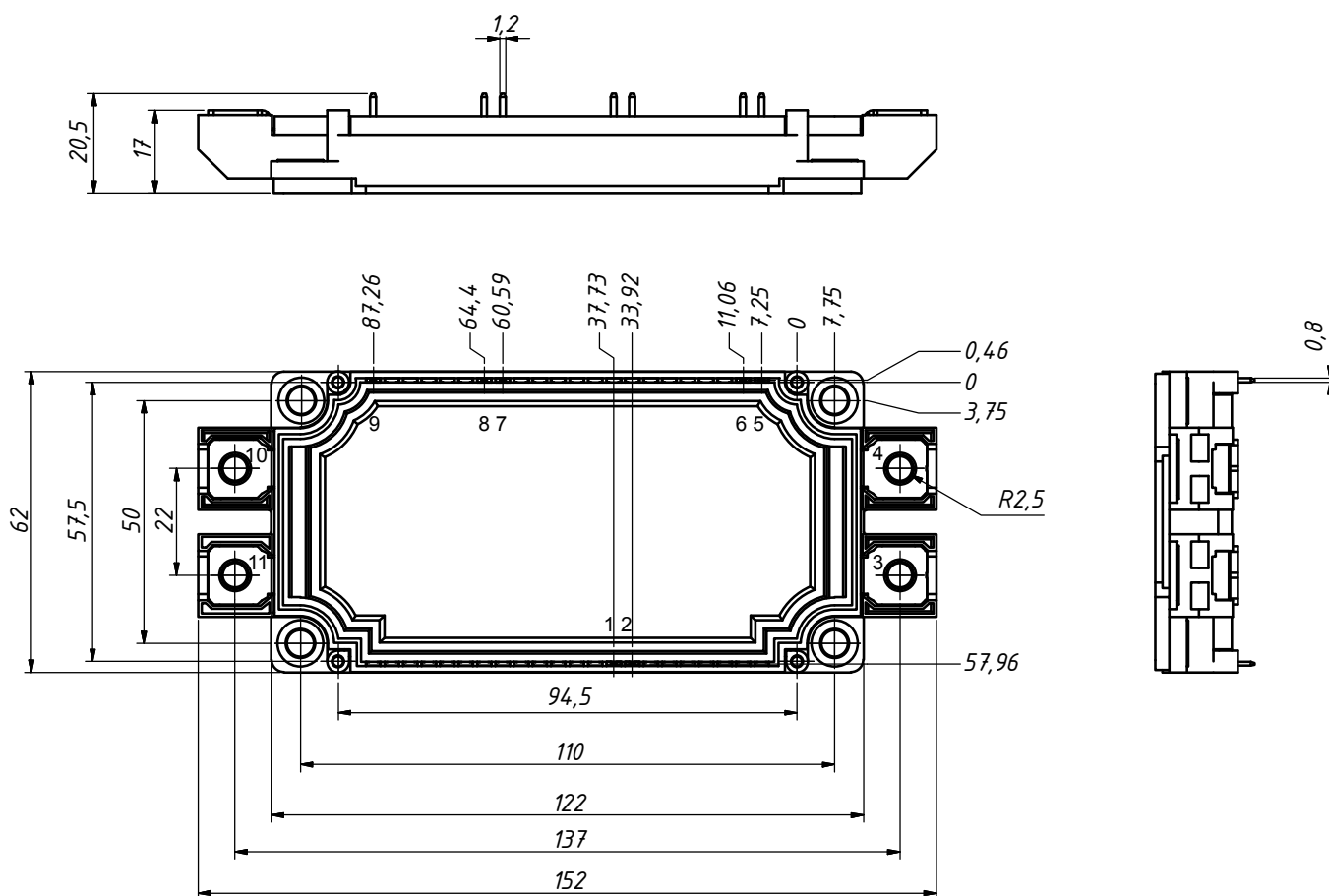
3.1

1.9

mΩ



**Outlines SimBus F**



## IGBT

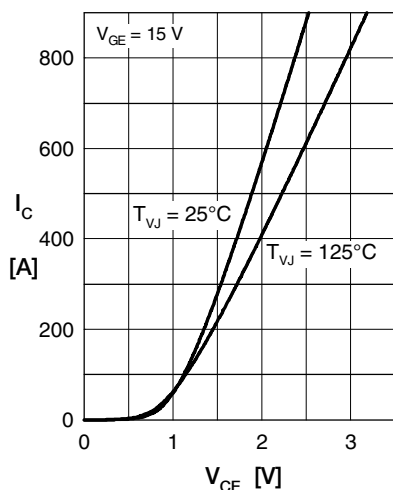


Fig. 1 Typ. output characteristics

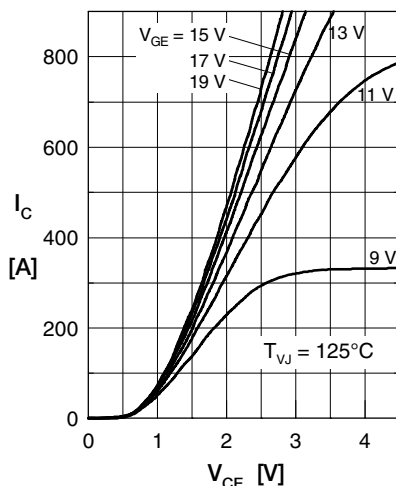


Fig. 2 Typ. output characteristics

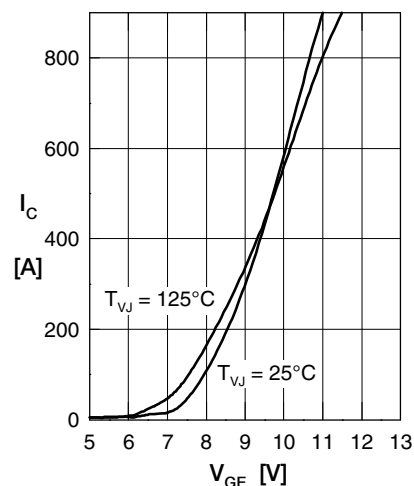


Fig. 3 Typ. transfer characteristics

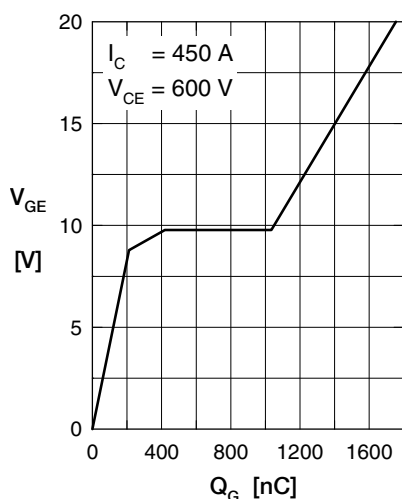


Fig. 4 Typ. turn-on gate charge

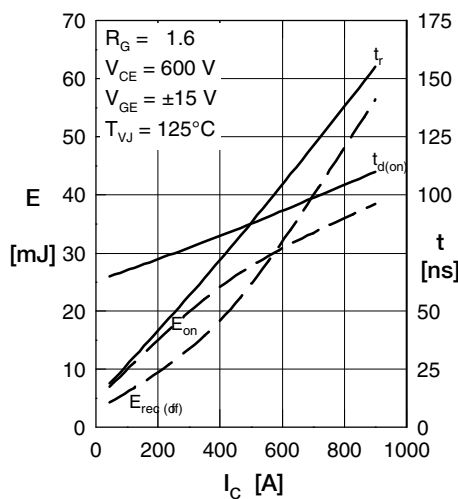


Fig. 5 Typ. turn-on energy & switching times vs. collector current, inductive switching

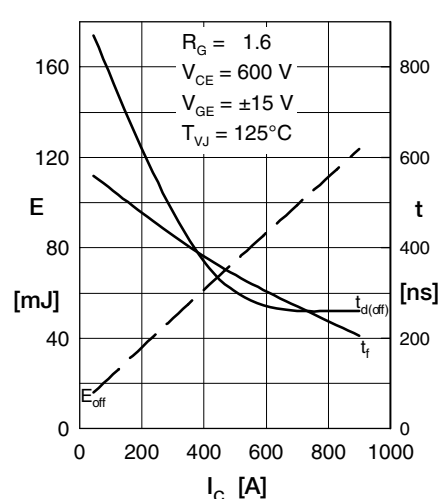


Fig. 6 Typ. switching energy versus gate resistance

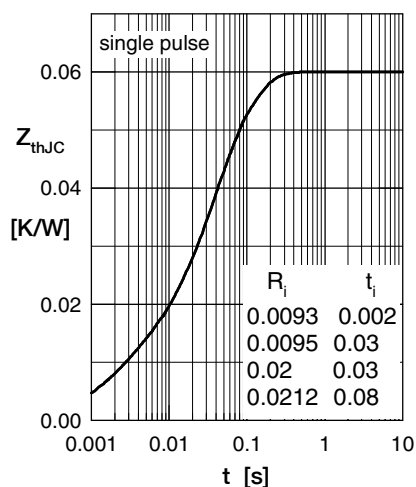


Fig. 7 Typ. trans. therm. impedance

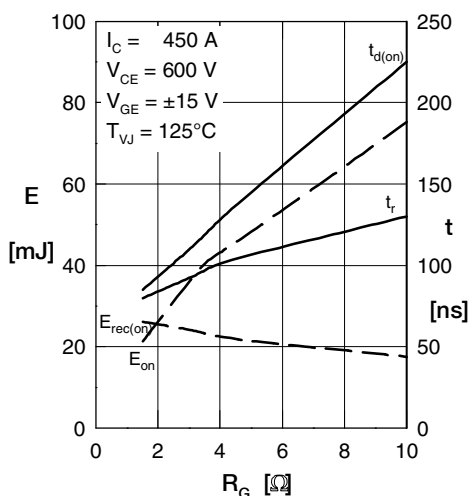


Fig. 8 Typ. turn-on energy, switching times vs. gate resistor, inductive switching

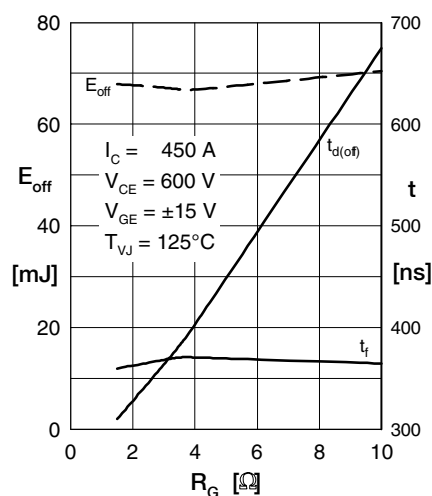


Fig. 9 Typ. turn-off energy, switching times vs. gate resistor, inductive switching

## Diode

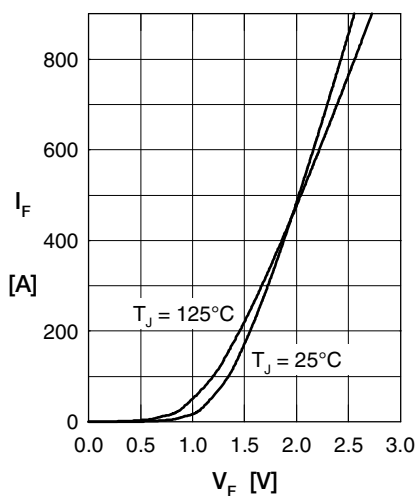


Fig. 1 Typ. Forward current versus  $V_F$

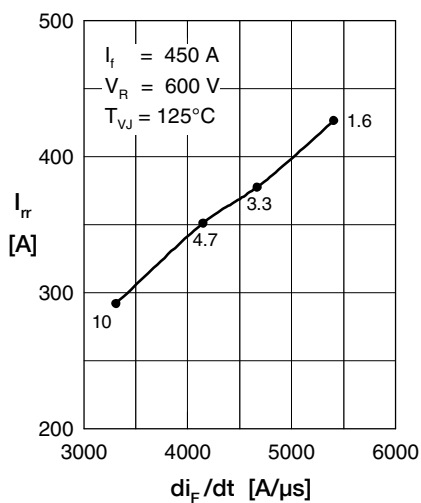


Fig. 2 Typ. reverse recovery characteristics

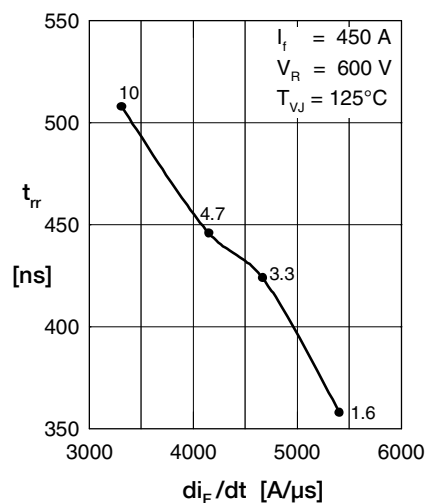


Fig. 3 Typ. reverse recovery characteristics

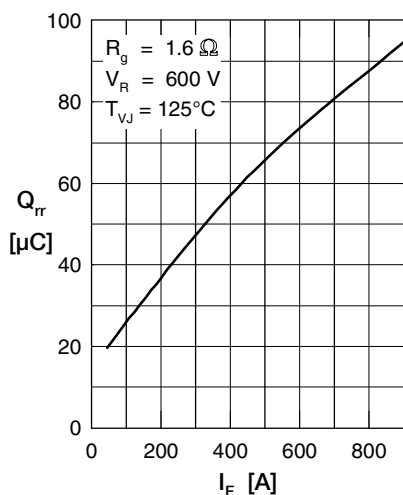


Fig. 4 Typ. reverse recovery characteristics

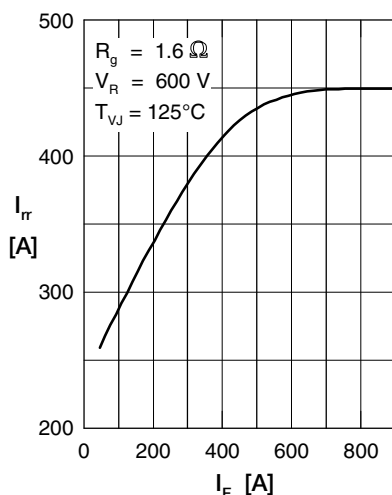


Fig. 5 Typ. reverse recovery characteristics

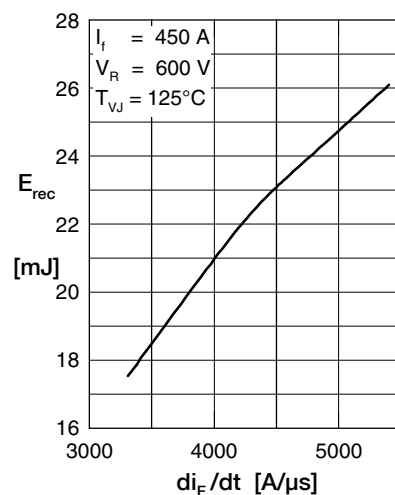


Fig. 6 Typ. recovery energy  $E_{rec}$  versus  $-di/dt$

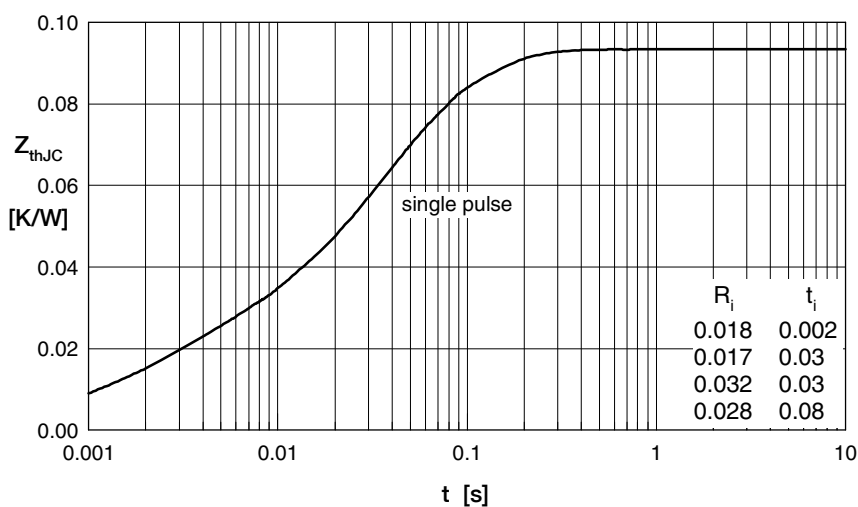


Fig. 7 Typ. transient thermal impedance junction to case