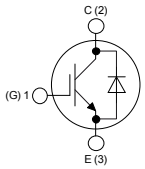
# XPT IGBT

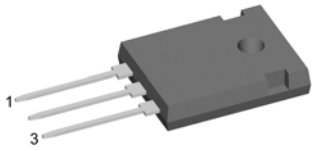
Copack

$I_{C25}$ = 58 A
$V_{CES}$ = 1200 V
$V_{CE(sat)typ}$ = 1.8 V

**Part number**

IXA33IF1200HB




**Features / Advantages:**

- 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
  - low EMI
  - square RBSOA @ 3x Ic
- Thin wafer technology combined with the XPT design results in a competitive low VCE(sat)
- SONIC™ diode
  - fast and soft reverse recovery
  - low operating forward voltage

**Applications:**

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

**Package:**

- Housing: TO-247
- Industry standard outline
- Epoxy meets UL 94V-0
- RoHS compliant

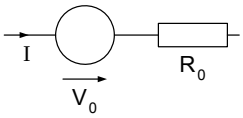
## IGBT

| | | | | Ratings | | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | **Definition** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| $V_{CES}$ | *Collector emitter voltage* | $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | | 1200 | V |
| $V_{GES}$ | *Maximum DC gate voltage* | | $T_{VJ}$ = 25°C | | | ±20 | V |
| $I_{C25}$ | *Collector current* | | $T_C$ = 25°C | | | 58 | A |
| $I_{C100}$ | | | $T_C$ = 100°C | | | 34 | A |
| $P_{tot}$ | *Total power dissipation* | | $T_{VJ}$ = 25°C | | | 250 | W |
| $I_{CES}$ | *Collector emitter leakage current* | $V_{CE}$ = $V_{CES}$ ; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | | 0.1 | mA |
| | | | $T_{VJ}$ = 125°C | | 0.1 | | mA |
| $I_{GES}$ | *Gate emitter leakage current* | $V_{CE}$ = 0 V; $V_{GE}$ = ±20 V | | | | 500 | nA |
| $V_{CE(sat)}$ | *Collector emitter saturation voltage* | $I_C$ = 25 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 mA; $V_{GE}$ = $V_{CE}$ | | 5.4 | 6 | 6.5 | V |
| $Q_{Gon}$ | *Total gate charge* | $V_{CE}$ = 600 V; $V_{GE}$ = 15 V; $I_C$ = 25 A | | | 76 | | 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 | | | 250 | | ns |
| $t_f$ | *Current fall time* | $V_{CE}$ = 600 V; $I_C$ = 25 A | | | 100 | | ns |
| $E_{on}$ | *Turn-on energy per pulse* | $V_{GE}$ = ±15 V; $R_G$ = 39 Ω | $T_{VJ}$ = 125°C | | 2.5 | | mJ |
| $E_{off}$ | *Turn-off energy per pulse* | | | | 3.0 | | mJ |
| RBSOA | *Reverse bias safe operation area* | $V_{GE}$ = 15 V; $R_G$ = 39 Ω<br>$V_{CEK}$ = 1200 V | $T_{VJ}$ = 125°C | | | 75 | A |
| SCSOA | *Short circuit safe operation 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* | $R_G$ = 39 Ω; non-repetitive | | | | 100 | A |
| $R_{thJC}$ | *Thermal resistance juntion to case* | | | | | 0.5 | K/W |

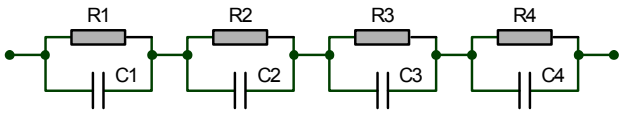
## Diode

| Symbol | Definition | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $I_{F25}$ | *Forward current* | $T_C$ = 25°C | | | | 60 | A |
| $I_{F100}$ | | $T_C$ = 100 °C | | | | 33 | A |
| $V_F$ | *Forward voltage* | $I_F$ = 30 A | $T_{VJ}$ = 25°C | | 1.95 | 2.2 | V |
| | | | $T_{VJ}$ = 125 °C | | 1.95 | | V |
| $Q_{rr}$ | *Reverse recovery charge* | $V_R$ = 600 V<br>$di_F/dt$ = - 600 A/µs;<br>$I_F$ = 30 A | $T_{VJ}$ = 125 °C | | 3.5 | | µC |
| $I_{RM}$ | *Maximum reverse recovery current* | | | | 30 | | A |
| $t_{rr}$ | *Reverse recovery time* | | | | 350 | | ns |
| $E_{rec(off)}$ | *Reverse recovery losses at turn-off* | | | | 0.9 | | mJ |
| $R_{thJC}$ | *Thermal resistance juntion to case* | | | | | 0.7 | K/W |

## Equivalent Circuits for Simulation




| Symbol | Definition | Conditions | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| $V_0$ | *IGBT* | $T_{VJ}$ = 150 °C | | | 1.1 | V |
| $R_0$ | | | | | 55 | mΩ |
| $V_0$ | *Diode* | $T_{VJ}$ = 150 °C | | | 1.25 | V |
| $R_0$ | | | | | 28.3 | mΩ |




$$Zth(t) = \sum_{i=1}^{n} \left[ R_i \cdot \left( 1 - \exp\left( -\frac{t}{\tau_i} \right) \right) \right]$$

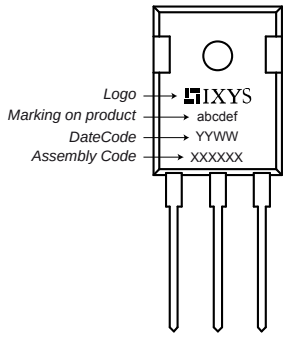
$$\tau_i = R_i \cdot C_i$$

| | IGBT | Diode |
|---|---|---|
| $R_1$ | 0.116 | 0.16 |
| $R_2$ | 0.1 | 0.12 |
| $R_3$ | 0.112 | 0.15 |
| $R_4$ | 0.172 | 0.27 |
| $\tau_1$ | 0.0006 | 0.0005 |
| $\tau_2$ | 0.2 | 0.004 |
| $\tau_3$ | 0.006 | 0.02 |
| $\tau_4$ | 0.05 | 0.15 |

## Package TO-247

| Symbol | Definition | Conditions | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| $T_{VJ}$ | *Virtual junction temperature* | | -55 | | 150 | °C |
| $T_{stg}$ | *Storage temperature* | | -55 | | 150 | °C |
| $R_{thCH}$ | *Thermal resistance case to heatsink* | | | 0.25 | | K/W |
| **Weight** | | | | 6 | | g |
| $M_D$ | *Mounting torque* | | 0.8 | | 1.2 | Nm |
| $F_C$ | *Mounting force with clip* | | 20 | | 120 | N |

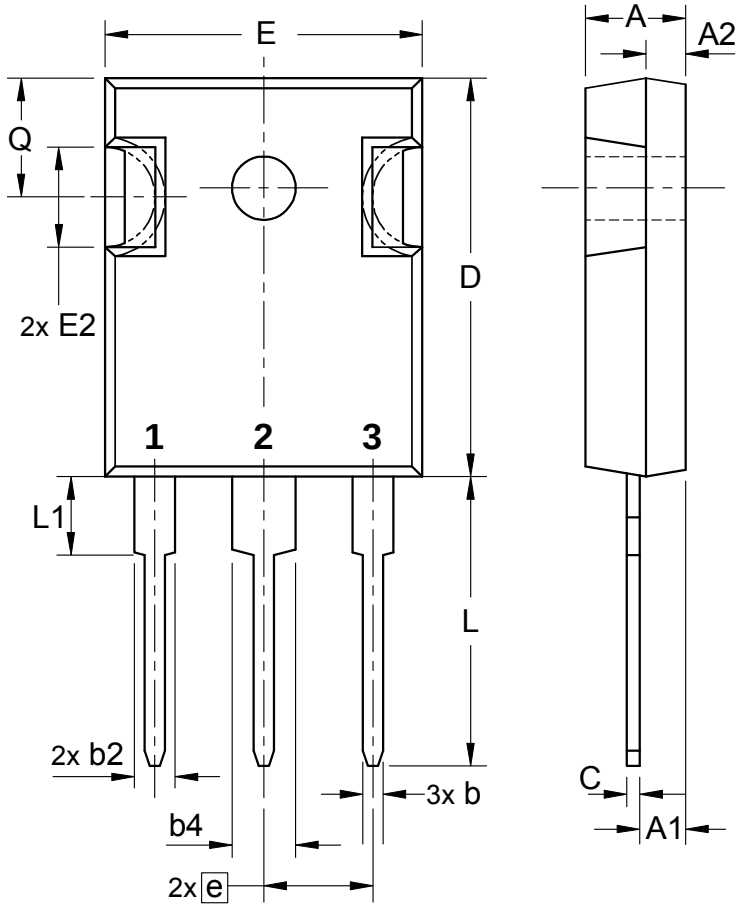
**Product Marking**

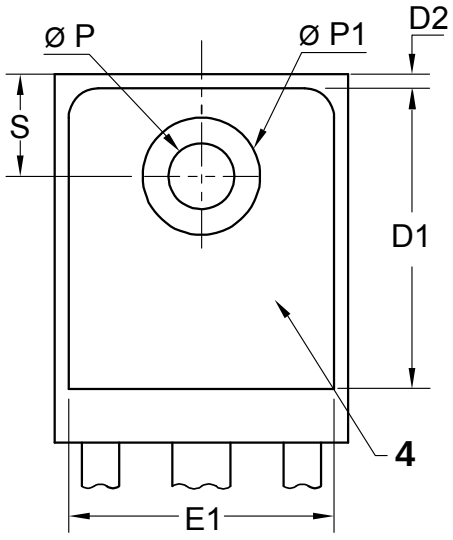



**Part number**

I = IGBT
X = XPT IGBT
A = Gen 1 / std
33 = Current Rating [A]
IF = Copack
1200 = Reverse Voltage [V]
HB = TO-247AD (3)

| Ordering | Part Name | Marking on Product | Delivering Mode | Base Qty | Code Key |
|---|---|---|---|---|---|
| **Standard** | IXA 33 IF 1200 HB | IXA33IF1200HB | | | |




| Sym. | Inches | | Millimeter | |
|---|---|---|---|---|
| | min. | max. | min. | max. |
| A | 0.185 | 0.209 | 4.70 | 5.30 |
| A1 | 0.087 | 0.102 | 2.21 | 2.59 |
| A2 | 0.059 | 0.098 | 1.50 | 2.49 |
| D | 0.819 | 0.845 | 20.79 | 21.45 |
| E | 0.610 | 0.640 | 15.48 | 16.24 |
| E2 | 0.170 | 0.216 | 4.31 | 5.48 |
| e | 0.215 BSC | | 5.46 BSC | |
| L | 0.780 | 0.800 | 19.80 | 20.30 |
| L1 | - | 0.177 | - | 4.49 |
| Ø P | 0.140 | 0.144 | 3.55 | 3.65 |
| Q | 0.212 | 0.244 | 5.38 | 6.19 |
| S | 0.242 BSC | | 6.14 BSC | |
| b | 0.039 | 0.055 | 0.99 | 1.40 |
| b2 | 0.065 | 0.094 | 1.65 | 2.39 |
| b4 | 0.102 | 0.135 | 2.59 | 3.43 |
| c | 0.015 | 0.035 | 0.38 | 0.89 |
| D1 | 0.515 | - | 13.07 | - |
| D2 | 0.020 | 0.053 | 0.51 | 1.35 |
| E1 | 0.530 | - | 13.45 | - |
| Ø P1 | - | 0.29 | - | 7.39 |

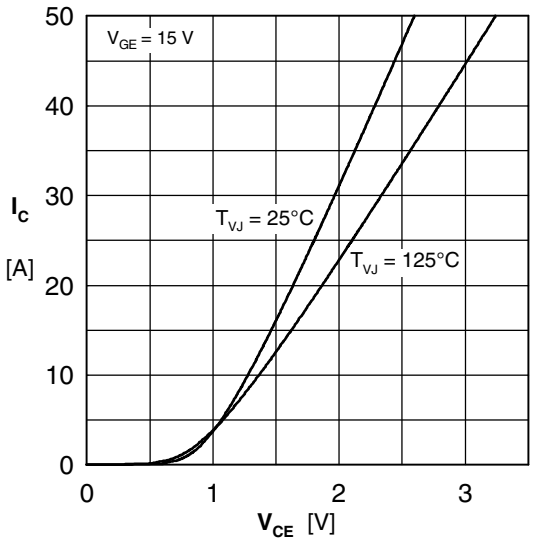



Fig. 1 Typ. output characteristics

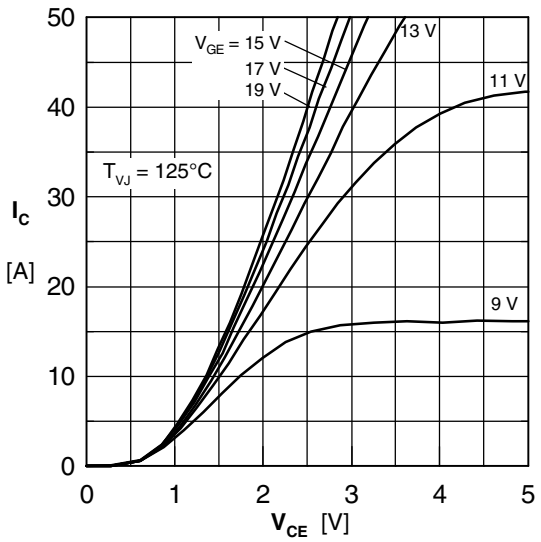



Fig. 2 Typ. output characteristics

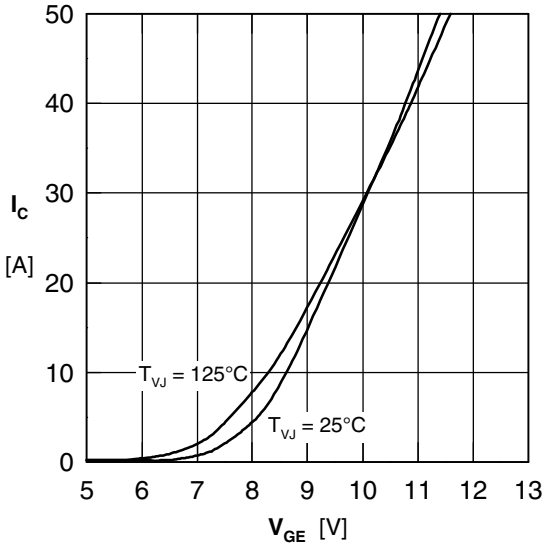



Fig. 3 Typ. tranfer characteristics

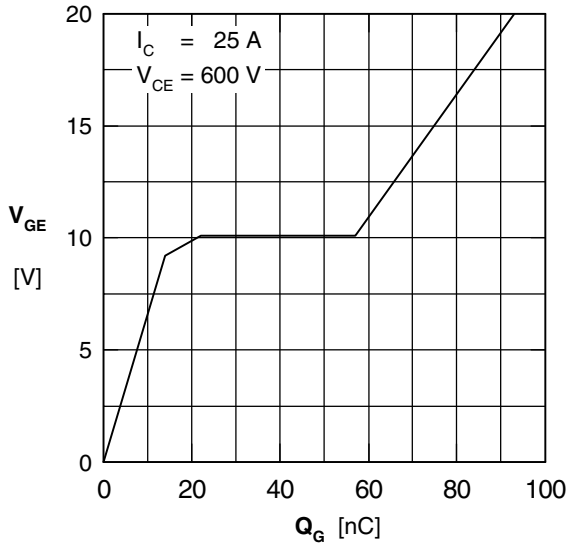



Fig. 4 Typ. turn-on gate charge

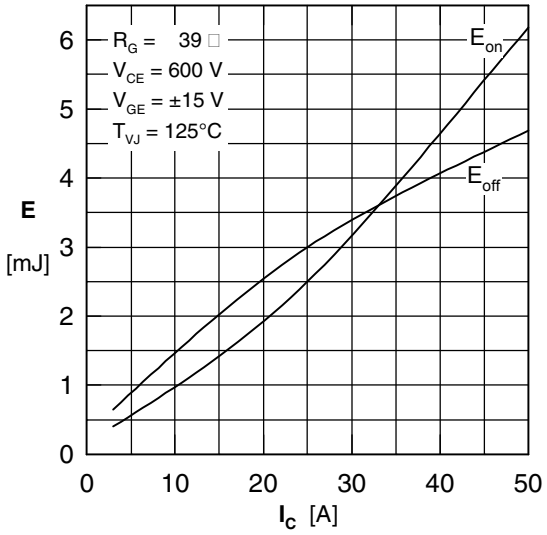



Fig. 5 Typ. switching energy vs. collector current

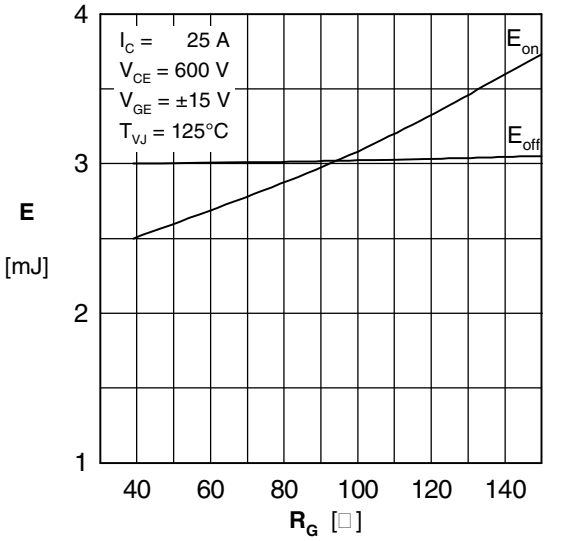



Fig. 6 Typ. switching energy vs. gate resistance

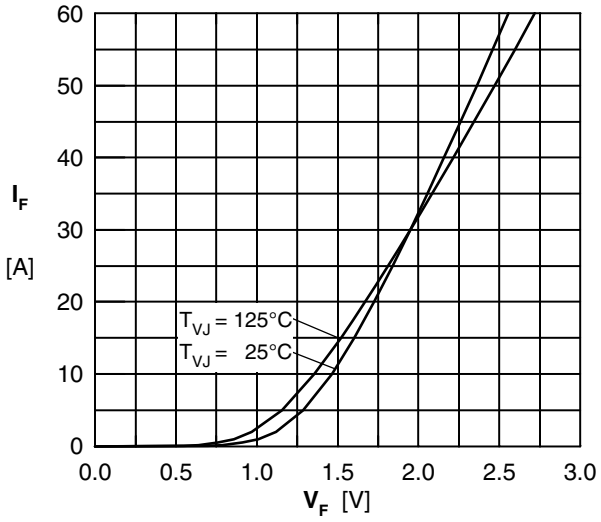



Fig. 7 Typ. Forward current versus $V_F$

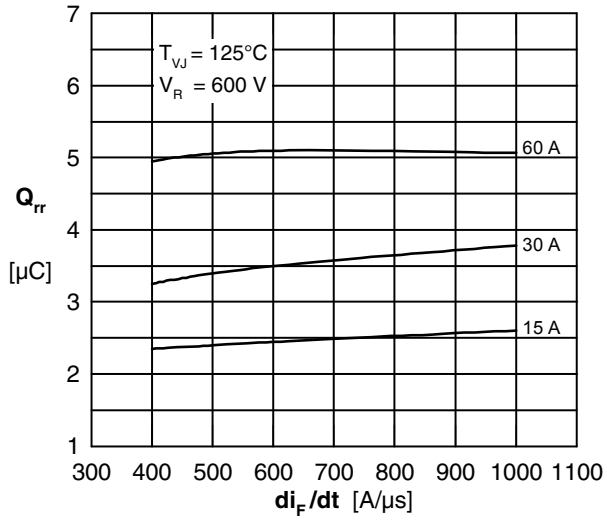



Fig. 8 Typ. reverse recov.charge $Q_{rr}$ vs. di/dt

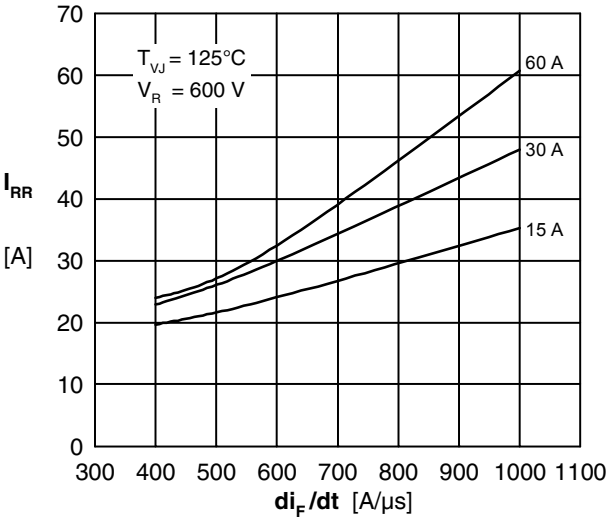



Fig. 9 Typ. peak reverse current $I_{RM}$ vs. di/dt

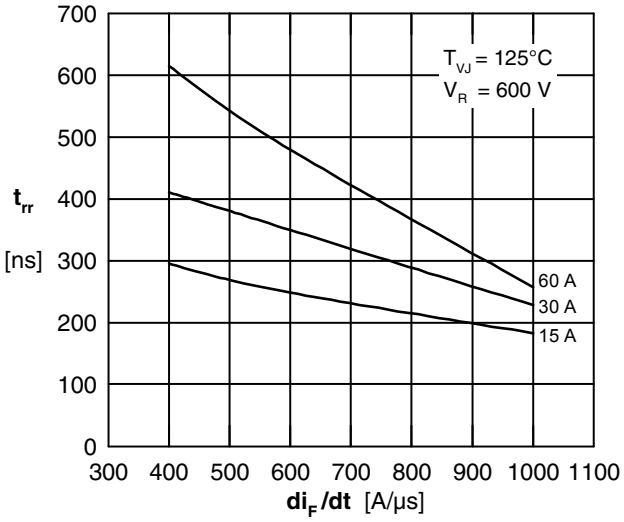



Fig. 10 Typ. recovery time $t_{rr}$ versus di/dt

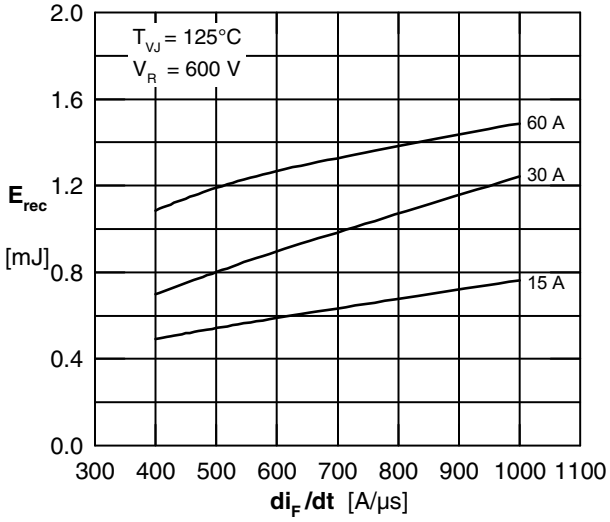



Fig.11 Typ. recovery energy $E_{rec}$ versus di/dt

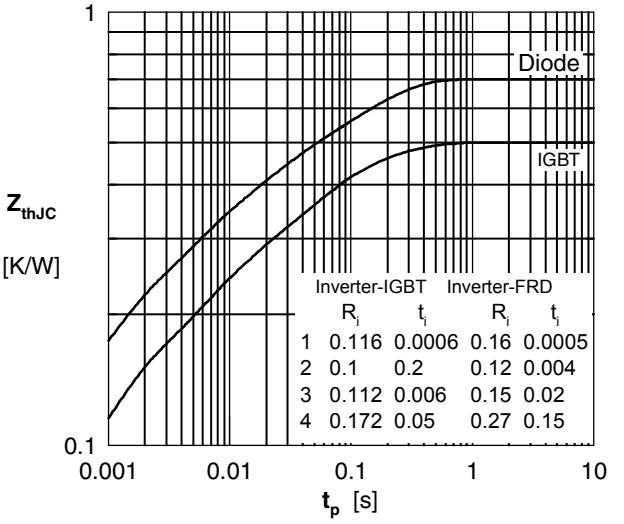



Fig. 12 Typ. transient thermal impedance