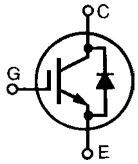
IXYS

# HiPerFAST™ IGBT with Diode

**IXGH 32N60BU1**

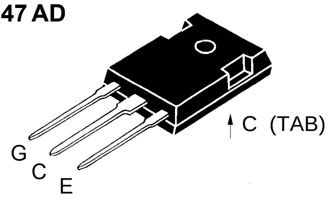
| | | | |
|---|---|---|---|
| $V_{CES}$ | = | 600 | V |
| $I_{C25}$ | = | 60 | A |
| $V_{CE(sat)}$ | = | 2.3 | V |
| $t_{fi}$ | = | 80 | ns |



| Symbol | Test Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_J$ = 25°C to 150°C | 600 | V |
| $V_{CGR}$ | $T_J$ = 25°C to 150°C; $R_{GE}$ = 1 MΩ | 600 | V |
| $V_{GES}$ | Continuous | ±20 | V |
| $V_{GEM}$ | Transient | ±30 | V |
| $I_{C25}$ | $T_C$ = 25°C | 60 | A |
| $I_{C90}$ | $T_C$ = 90°C | 32 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1 ms | 120 | A |
| **SSOA**<br>**(RBSOA)** | $V_{GE}$ = 15 V, $T_{VJ}$ = 125°C, $R_G$ = 33 Ω<br>Clamped inductive load, L = 100 µH | $I_{CM}$ = 64<br>@ 0.8 $V_{CES}$ | A |
| $P_C$ | $T_C$ = 25°C | 200 | W |
| $T_J$ | | -55 ... +150 | °C |
| $T_{JM}$ | | 150 | °C |
| $T_{stg}$ | | -55 ... +150 | °C |
| Maximum Lead and Tab temperature for soldering 1.6 mm (0.062 in.) from case for 10 s | | 300 | °C |
| $M_d$ | Mounting torque, TO-247 AD | 1.13/10 | Nm/lb.in. |
| **Weight** | | 6 | g |

| Symbol | Test Conditions | | Characteristic Values ($T_J$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|---|
| $BV_{CES}$ | $I_C$ = 750µA, $V_{GE}$ = 0 V | | 600 | | | V |
| $V_{GE(th)}$ | $I_C$ = 250 µA, $V_{CE}$ = $V_{GE}$ | | 2.5 | | 5.0 | V |
| $I_{CES}$ | $V_{CE}$ = 0.8 • $V_{CES}$ | $T_J$ = 25°C | | | 500 | µA |
| | $V_{GE}$ = 0 V | $T_J$ = 125°C | | | 8 | mA |
| $I_{GES}$ | $V_{CE}$ = 0 V, $V_{GE}$ = ±20 V | | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = $I_{C90}$, $V_{GE}$ = 15 V | | | | 2.3 | V |

**TO-247 AD**



G = Gate, C = Collector,
E = Emitter, TAB = Collector

### Features

- International standard packages JEDEC TO-247 SMD
- High frequency IGBT and antiparallel FRED in one package
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on
  - drive simplicity

### Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

### Advantages

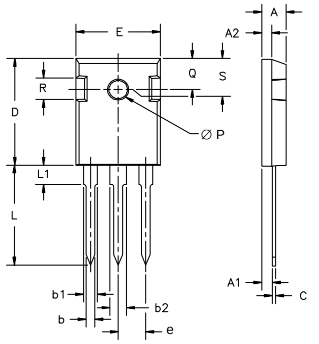
- Space savings (two devices in one package)
- High power density
- Very fast switching speeds for high frequency applications

| Symbol | Test Conditions | Characteristic Values ($T_J$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|
| $g_{fs}$ | $I_C$ = $I_{C90}$; $V_{CE}$ = 10 V,<br>Pulse test, t ≤ 300 µs, duty cycle ≤ 2 % | 15 | 25 | | S |
| $C_{ies}$ | $V_{CE}$ = 25 V, $V_{GE}$ = 0 V, f = 1 MHz | | 2700 | | pF |
| $C_{oes}$ | | | 270 | | pF |
| $C_{res}$ | | | 50 | | pF |
| $Q_G$ | $I_C$ = $I_{C90}$, $V_{GE}$ = 15 V, $V_{CE}$ = 0.5 $V_{CES}$ | | 110 | 150 | nC |
| $Q_{GE}$ | | | 23 | 35 | nC |
| $Q_{GC}$ | | | 40 | 75 | nC |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 25°C**<br>$I_C$ = $I_{C90}$, $V_{GE}$ = 15 V, L = 100 µH,<br>$V_{CE}$ = 0.8 $V_{CES}$, $R_G$ = $R_{off}$ = 4.7 Ω<br>Remarks: Switching times may increase for $V_{CE}$ (Clamp) > 0.8 • $V_{CES}$, higher $T_J$ or increased $R_G$ | | 25 | | ns |
| $t_{ri}$ | | | 20 | | ns |
| $t_{d(off)}$ | | | 100 | 200 | ns |
| $t_{fi}$ | | | 80 | 150 | ns |
| $E_{off}$ | | | 0.6 | 1.2 | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 125°C**<br>$I_C$ = $I_{C90}$, $V_{GE}$ = 15 V, L = 100 µH<br>$V_{CE}$ = 0.8 $V_{CES}$, $R_G$ = $R_{off}$ = 4.7 Ω<br>Remarks: Switching times may increase for $V_{CE}$ (Clamp) > 0.8 • $V_{CES}$, higher $T_J$ or increased $R_G$ | | 25 | | ns |
| $t_{ri}$ | | | 25 | | ns |
| $E_{on}$ | | | 1 | | mJ |
| $t_{d(off)}$ | | | 120 | | ns |
| $t_{fi}$ | | | 120 | | ns |
| $E_{off}$ | | | 1.2 | | mJ |
| $R_{thJC}$ | | | | 0.62 | K/W |
| $R_{thCK}$ | | | 0.25 | | K/W |

**Reverse Diode (FRED)**

| Symbol | Test Conditions | Characteristic Values ($T_J$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|
| $V_F$ | $I_F$ = $I_{C90}$, $V_{GE}$ = 0 V,<br>Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 % | | | 1.6 | V |
| $I_{RM}$ | $I_F$ = $I_{C90}$, $V_{GE}$ = 0 V, -$di_F$/dt = 240 A/µs | | 10 | 15 | A |
| $t_{rr}$ | $V_R$ = 360 V $T_J$ = 125°C | | 150 | | ns |
| | $I_F$ = 1 A; -di/dt = 100 A/µs; $V_R$ = 30 V $T_J$ = 25°C | | 35 | 50 | ns |
| $R_{thJC}$ | | | | 1 | K/W |

**TO-247 AD Outline**



| Dim. | Millimeter | | Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 4.7 | 5.3 | .185 | .209 |
| $A_1$ | 2.2 | 2.54 | .087 | .102 |
| $A_2$ | 2.2 | 2.6 | .059 | .098 |
| b | 1.0 | 1.4 | .040 | .055 |
| $b_1$ | 1.65 | 2.13 | .065 | .084 |
| $b_2$ | 2.87 | 3.12 | .113 | .123 |
| C | .4 | .8 | .016 | .031 |
| D | 20.80 | 21.46 | .819 | .845 |
| E | 15.75 | 16.26 | .610 | .640 |
| e | 5.20 | 5.72 | 0.205 | 0.225 |
| L | 19.81 | 20.32 | .780 | .800 |
| L1 | | 4.50 | | .177 |
| ∅P | 3.55 | 3.65 | .140 | .144 |
| Q | 5.89 | 6.40 | 0.232 | 0.252 |
| R | 4.32 | 5.49 | .170 | .216 |
| S | 6.15 | BSC | 242 | BSC |

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

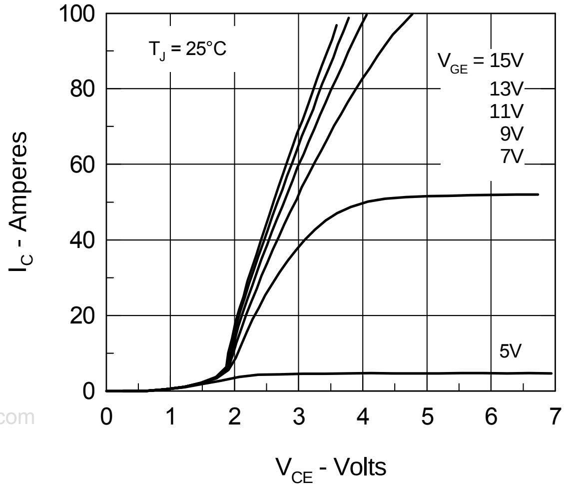


Fig. 1. Saturation Voltage Characteristics

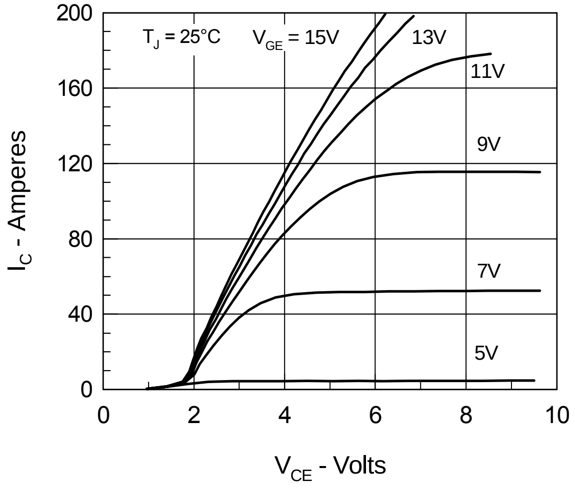


Fig. 2. Extended Output Characteristics

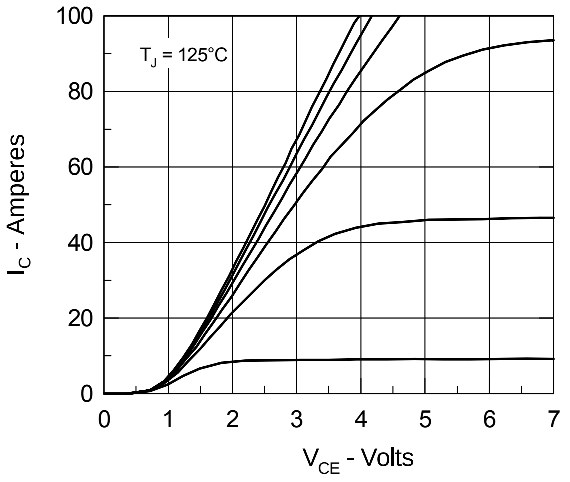


Fig. 3. Saturation Voltage Characteristics

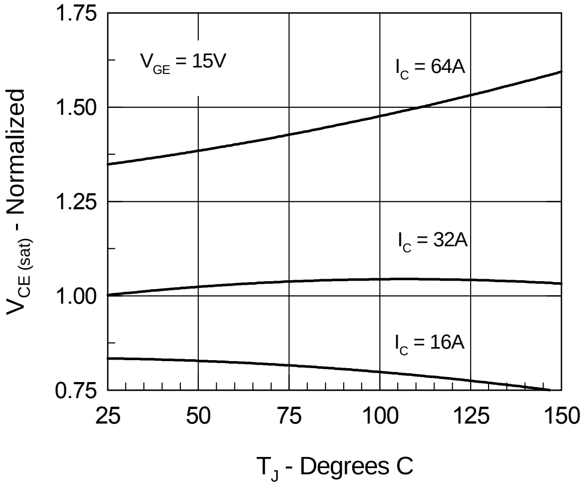


Fig. 4. Temperature Dependence of $V_{CE(sat)}$

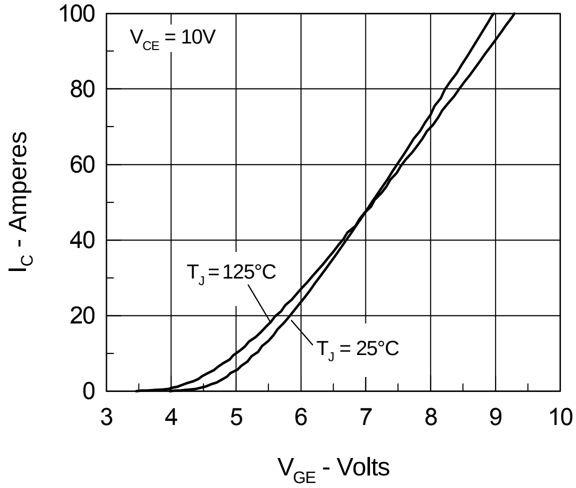


Fig. 5. Admittance Curves

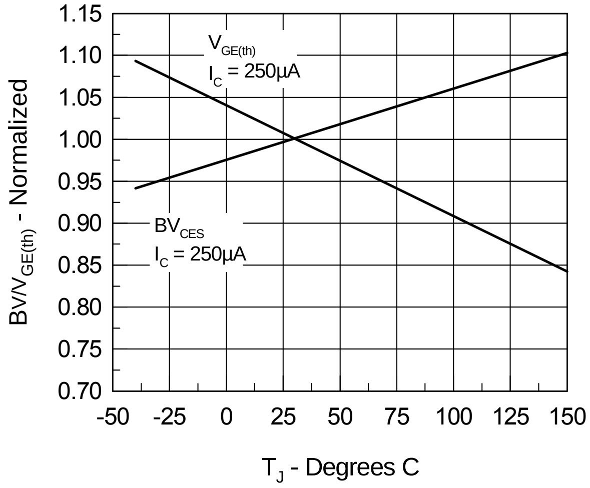


Fig. 6. Temperature Dependence of $BV_{DSS}$ & $V_{GE(th)}$

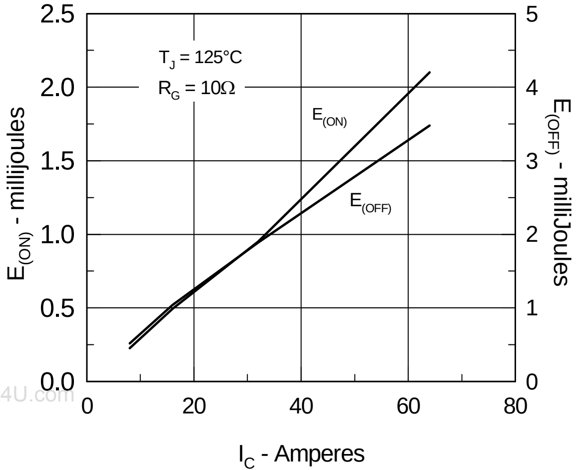


Fig. 7. Dependence of tfi and $E_{OFF}$ on $I_C$.

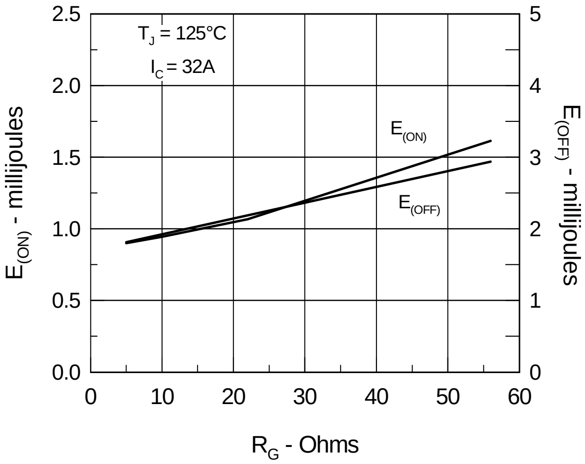


Fig. 8. Dependence of tfi and $E_{OFF}$ on $R_G$.

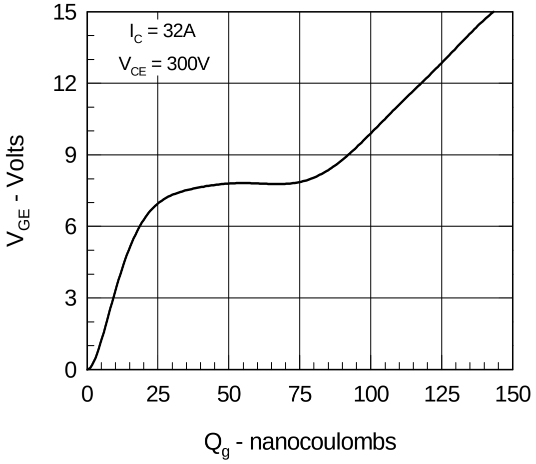


Fig. 9. Gate Charge

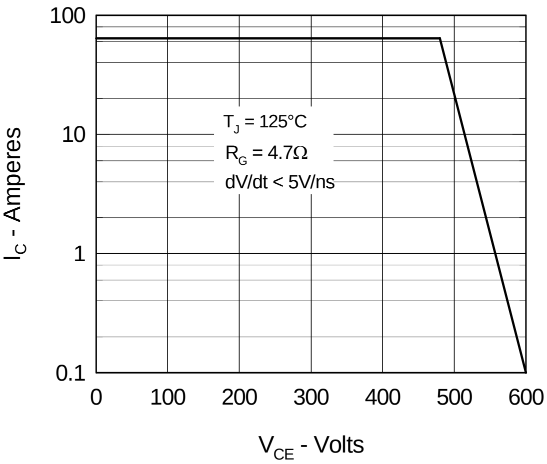


Fig. 10. Turn-off Safe Operating Area

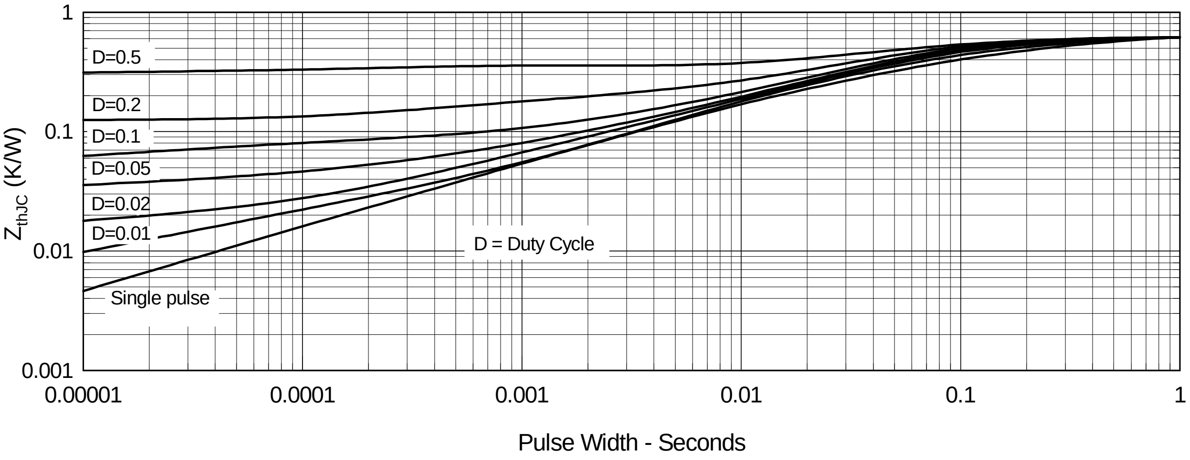


Fig. 11. Transient Thermal Resistance

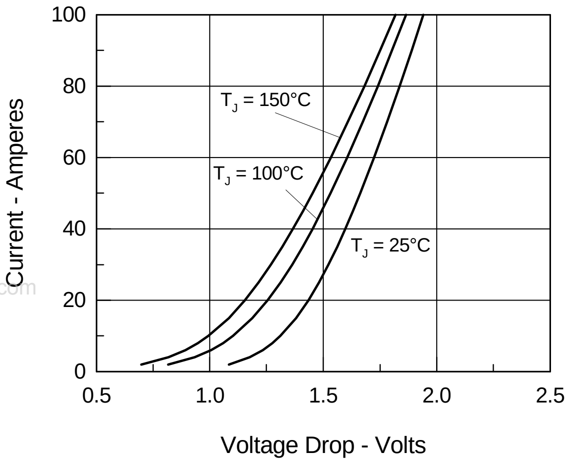


Fig.12 Maximum Forward Voltage Drop

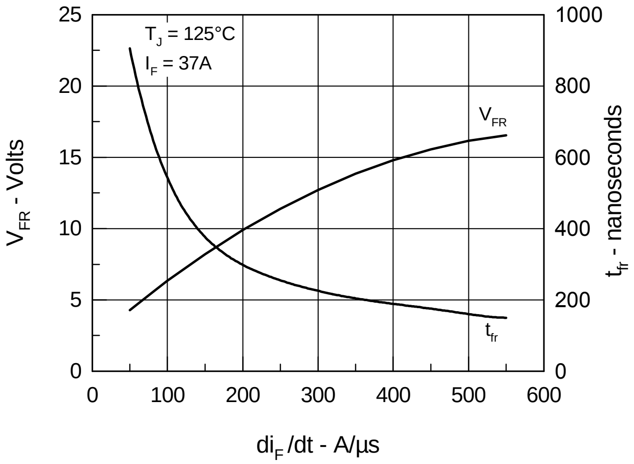


Fig.13 Peak Forward Voltage $V_{FR}$ and Forward Recovery Time $t_{FR}$

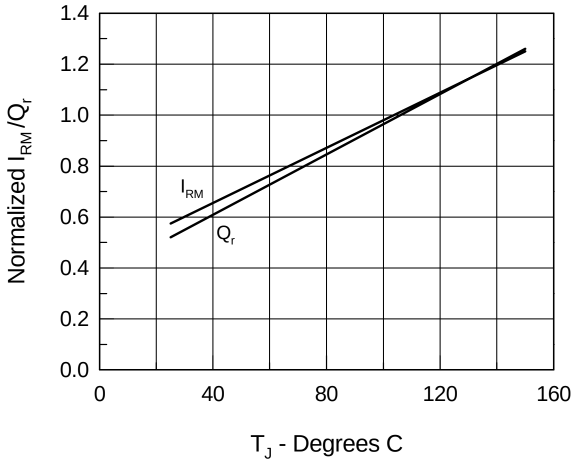


Fig.14 Junction Temperature Dependence off $I_{RM}$ and $Q_r$

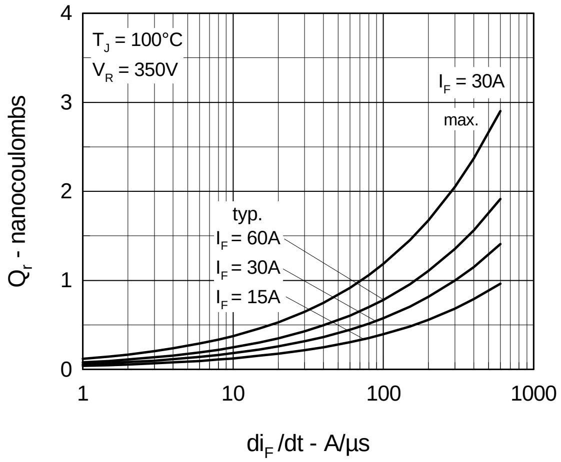


Fig.15 Reverse Recovery Chargee

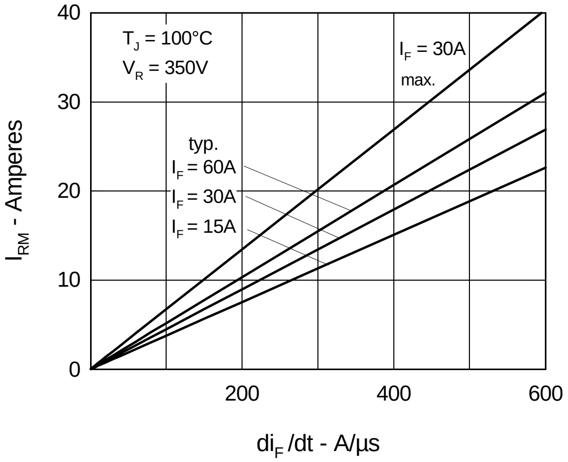


Fig.16 Peak Reverse Recovery Current

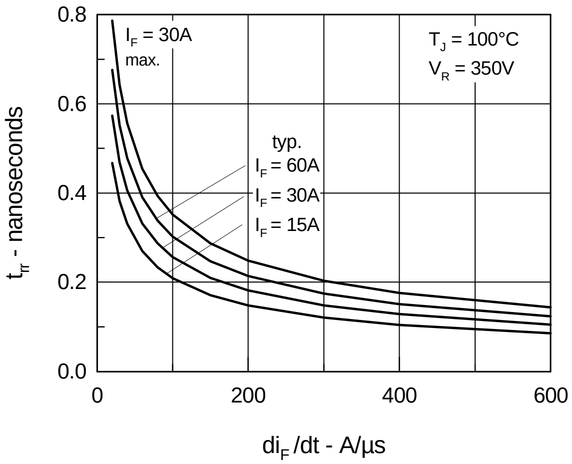


Fig.17 Reverse Recovery Time

Fig.18 Diode Transient Thermal resistance junction to case