# THE DATASHEET OF

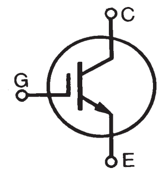
# IXGH16N170A

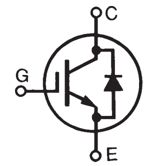
IXYS

# High Voltage IGBT w/ Sonic Diode

## IXGT16N170A
## IXGH16N170A
## IXGT16N170AH1
## IXGH16N170AH1

$V_{CES}$ = 1700V
$I_{C90}$ = 11A
$V_{CE(sat)}$ ≤ 5.0V
$t_{fi(typ)}$ = 35ns

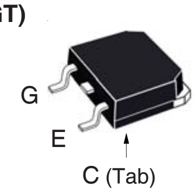


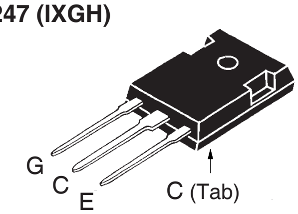

H1

| Symbol | Test Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_J$ = 25°C to 150°C | 1700 | V |
| $V_{CGR}$ | $T_J$ = 25°C to 150°C, $R_{GE}$ = 1MΩ | 1700 | V |
| $V_{GES}$ | Continuous | ±20 | V |
| $V_{GEM}$ | Transient | ±30 | V |
| $I_{C25}$ | $T_C$ = 25°C | 16 | A |
| $I_{C90}$ | $T_C$ = 90°C | 11 | A |
| $I_{F90}$ | $T_C$ = 90°C | 17 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1ms | 40 | A |
| SSOA (RBSOA) | $V_{GE}$ = 15V, $T_{VJ}$ = 125°C, $R_G$ = 10Ω Clamped Inductive Load | $I_{CM}$ = 40 0.8 • $V_{CES}$ | A |
| $t_{sc}$ (SCSOA) | $V_{GE}$ = 15V, $V_{CE}$ = 1200V, $T_J$ = 125°C $R_G$ = 22Ω, Non Repetitive | 10 | μs |
| $P_C$ | $T_C$ = 25°C | 190 | W |
| $T_J$ | | -55 ... +150 | °C |
| $T_{JM}$ | | 150 | °C |
| $T_{stg}$ | | -55 ... +150 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering | 300 | °C |
| $T_{SOLD}$ | Plastic Body for 10s | 260 | °C |
| $M_d$ | Mounting Torque (TO-247) | 1.13/10 | Nm/lb.in |
| Weight | TO-268 | 4 | g |
| | TO-247 | 6 | g |

**TO-268 (IXGT)**




**TO-247 (IXGH)**




G = Gate C = Collector
E = Emiiter Tab = Collector

### Features

- High Blocking Voltage
- International Standard Packages
- Low Conduction Losses
- Anti-Parallel Sonic Diode
- High Blocking Voltage
- High Currect Handling Capability

### Advantages

- Low Gate Drive Requirement
- High Power Density

### Applications

- Switch-Mode and Resonant-Mode Power Supplies
- Uninterruptible Power Supplies (UPS)
- AC Choppers
- Capacitor Discharge Circuits
- AC Motor Drives
- DC Servo & Robot Drives

| Symbol | Test Conditions ($T_J$ = 25°C, Unless Otherwise Specified) | | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|---|
| $BV_{CES}$ | $I_C$ = 250μA, $V_{GE}$ = 0V | | 1700 | | | V |
| $V_{GE(th)}$ | $I_C$ = 250μA, $V_{CE}$ = $V_{GE}$ | | 3.0 | | 5.0 | V |
| $I_{CES}$ | $V_{CE}$ = 0.8 • $V_{CES}$, $V_{GE}$ = 0V | 16N170A | | | 50 | μA |
| | | 16N170AH1 | | | 100 | μA |
| | $T_J$ = 125°C | 16N170A | | | 750 | μA |
| | | 16N170AH1 | | | 1.5 | mA |
| $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ±20V | | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = 11A, $V_{GE}$ = 15V, Note 1 | | | 4.0 | 5.0 | V |
| | $T_J$ = 125°C | | | 4.5 | | V |

# IXYS

## IXGH/T16N170A
## IXGH/T16N170AH1

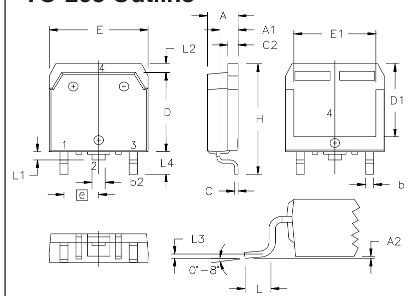
| Symbol | Test Conditions ($T_J$ = 25°C, Unless Otherwise Specified) | | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|---|
| $g_{fs}$ | $I_C$ = 16A, $V_{CE}$ = 10V, Note 1 | | 6.0 | 12.5 | | S |
| $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | | 1500 | | pF |
| $C_{oes}$ | | 16N170A | | 99 | | pF |
| | | 16N170AH1 | | 110 | | pF |
| $C_{res}$ | | | | 33 | | pF |
| $Q_{g(on)}$ | $I_C$ = 11A, $V_{GE}$ = 15V, $V_{CE}$ = 0.5 • $V_{CES}$ | | | 70 | | nC |
| $Q_{ge}$ | | | | 9 | | nC |
| $Q_{gc}$ | | | | 32 | | nC |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 25°C** | | | 12 | | ns |
| $t_{ri}$ | $I_C$ = 16A, $V_{GE}$ = 15V | | | 22 | | ns |
| $E_{on}$ | $V_{CE}$ = 0.5 • $V_{CES}$, $R_G$ = 10Ω | | | 2.35 | | mJ |
| $t_{d(off)}$ | Note 2 | | | 200 | 300 | ns |
| $t_{fi}$ | | | | 35 | 150 | ns |
| $E_{off}$ | | | | 0.38 | 1.50 | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 125°C** | | | 13 | | ns |
| $t_{ri}$ | $I_C$ = 16A, $V_{GE}$ = 15V | | | 22 | | ns |
| $E_{on}$ | $V_{CE}$ = 0.5 • $V_{CES}$, $R_G$ = 10Ω | | | 2.80 | | mJ |
| $t_{d(off)}$ | Note 2 | | | 210 | | ns |
| $t_{fi}$ | | | | 88 | | ns |
| $E_{off}$ | | | | 0.67 | | mJ |
| $R_{thJC}$ | | | | | 0.65 | °C/W |
| $R_{thCS}$ | | | | 0.21 | | °C/W |

### Reverse Sonic Diode (FRD)

| Symbol | Test Conditions ($T_J$ = 25°C, Unless Otherwise Specified) | | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|---|
| $V_F$ | $I_F$ = 20A, $V_{GE}$ = 0V, Note 1 | | | | 3.4 | V |
| | | $T_J$ = 125°C | | 2.8 | | |
| $t_{rr}$ | $I_F$ = 10A, $V_{GE}$ = 0V, | | | 300 | | ns |
| | -$di_F/dt$ = 250A/μs, $V_R$ = 900V | $T_J$ = 125°C | | 550 | | ns |
| $I_{RM}$ | | | | 13 | | A |
| | | $T_J$ = 125°C | | 15 | | A |
| $R_{thJC}$ | | | | | 1.5 | °C/W |

Notes:
1. Pulse test, t ≤ 300μs, duty cycle, d ≤ 2%.
2. Switching times & energy losses may increase for higher $V_{CE}$(clamp), $T_J$ or $R_G$.

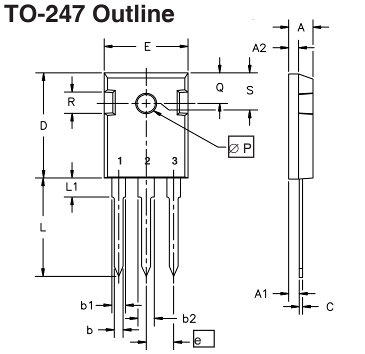
### TO-268 Outline



Terminals: 1 - Gate 2,4 - Collector
3 - Emitter

| SYM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | .193 | .201 | 4.90 | 5.10 |
| A1 | .106 | .114 | 2.70 | 2.90 |
| A2 | .001 | .010 | 0.02 | 0.25 |
| b | .045 | .057 | 1.15 | 1.45 |
| b2 | .075 | .083 | 1.90 | 2.10 |
| C | .016 | .026 | 0.40 | 0.65 |
| C2 | .057 | .063 | 1.45 | 1.60 |
| D | .543 | .551 | 13.80 | 14.00 |
| D1 | .488 | .500 | 12.40 | 12.70 |
| E | .624 | .632 | 15.85 | 16.05 |
| E1 | .524 | .535 | 13.30 | 13.60 |
| e | .215 BSC | | 5.45 BSC | |
| H | .736 | .752 | 18.70 | 19.10 |
| L | .094 | .106 | 2.40 | 2.70 |
| L1 | .047 | .055 | 1.20 | 1.40 |
| L2 | .039 | .045 | 1.00 | 1.15 |
| L3 | .010 BSC | | 0.25 BSC | |
| L4 | .150 | .161 | 3.80 | 4.10 |

### TO-247 Outline



Terminals: 1 - Gate 2 - Collector
3 - Emitter

| Dim. | Millimeter Min. | Millimeter Max. | Inches Min. | Inches 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 | |

**Fig. 1. Output Characteristics @ $T_J$ = 25ºC**

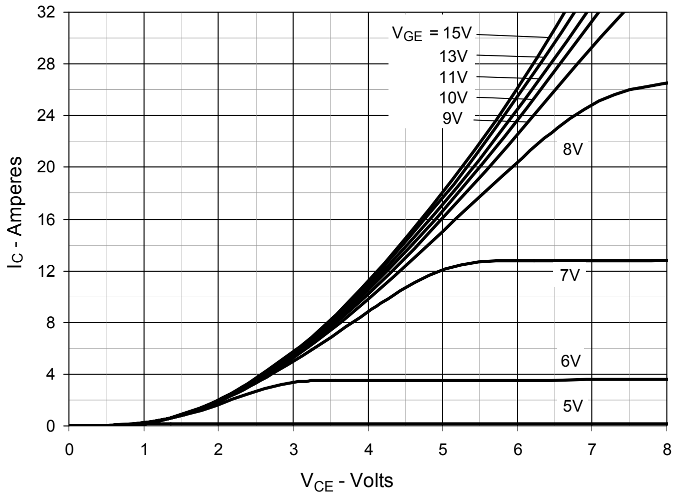



**Fig. 2. Extended Output Characteristics @ $T_J$ = 25ºC**

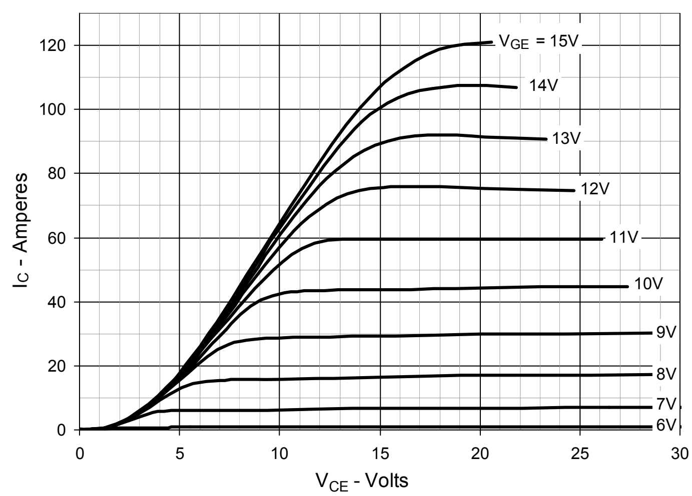



**Fig. 3. Output Characteristics @ $T_J$ = 125ºC**

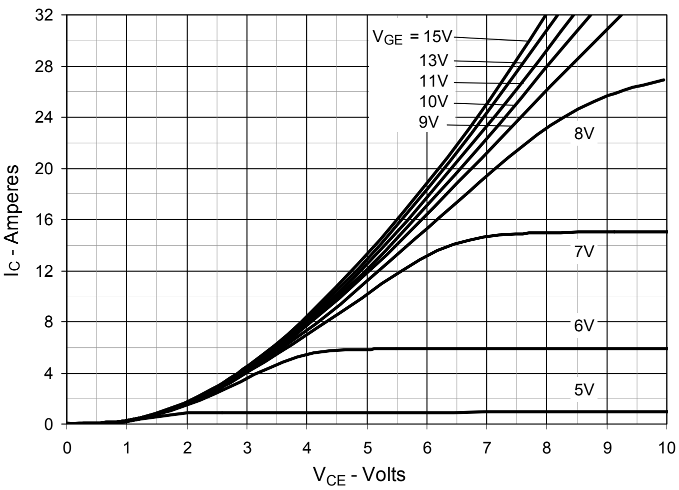



**Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature**

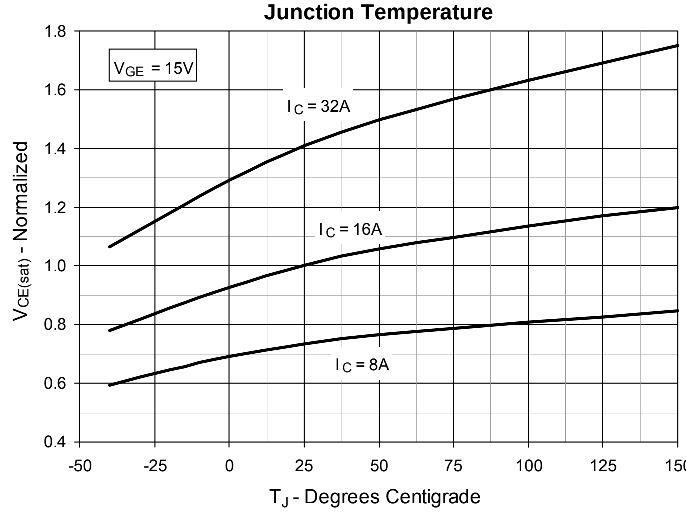



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

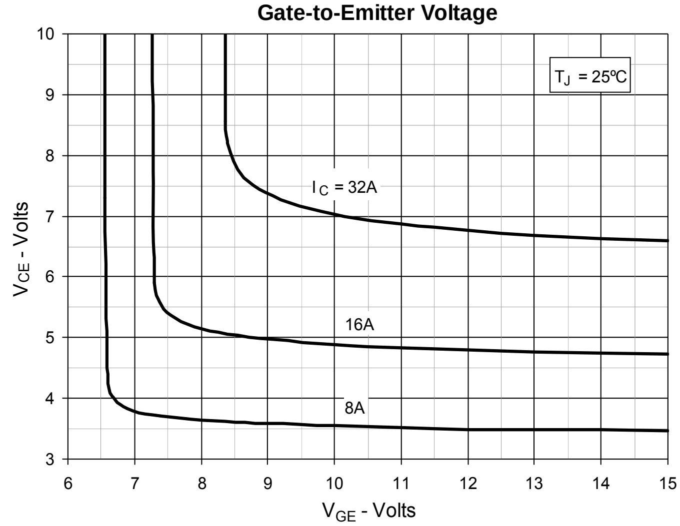



**Fig. 6. Input Admittance**

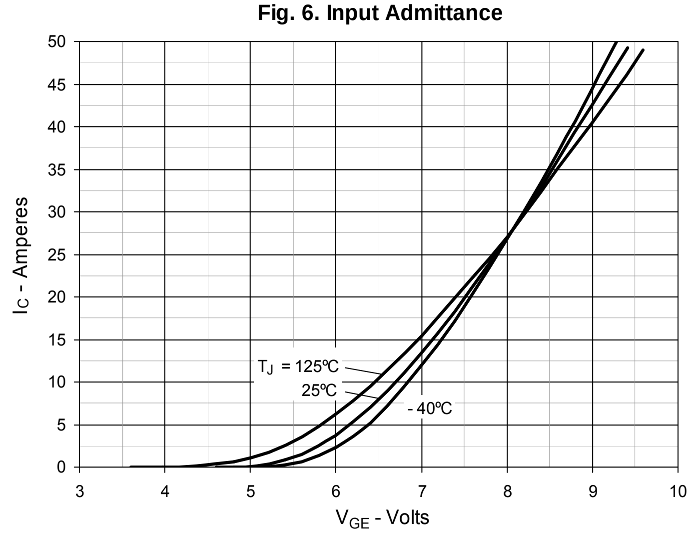


**Fig. 7. Transconductance**

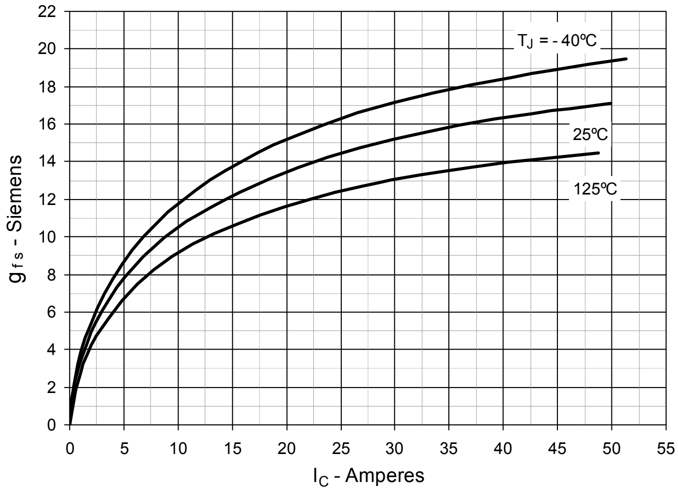



**Fig. 8. Gate Charge**

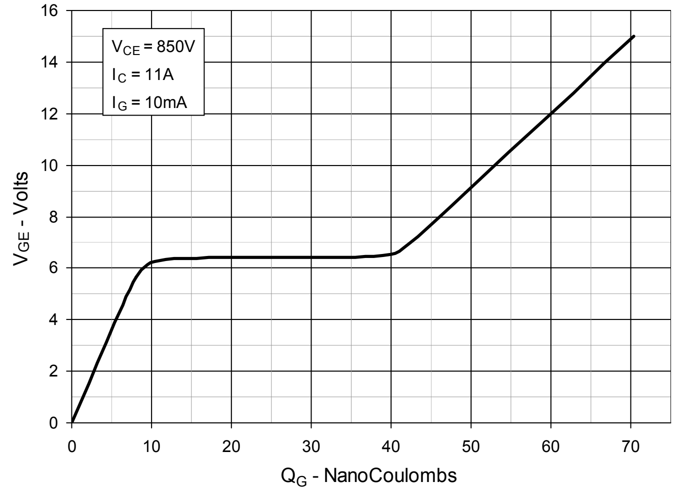



**Fig. 9. Capacitance**

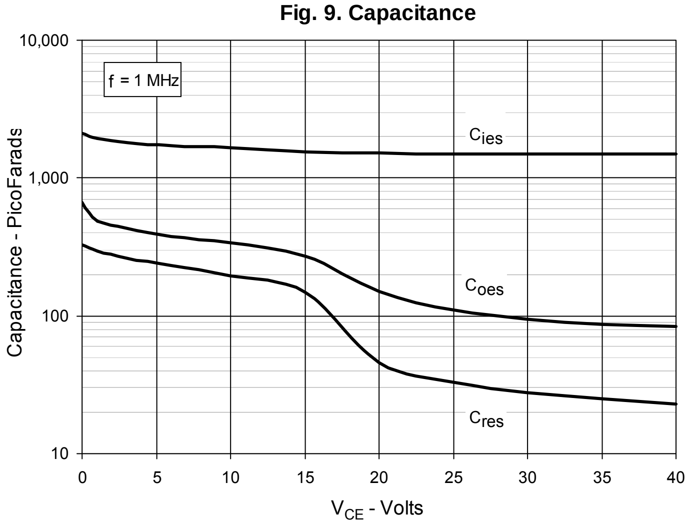



**Fig. 10. Reverse-Bias Safe Operating Area**

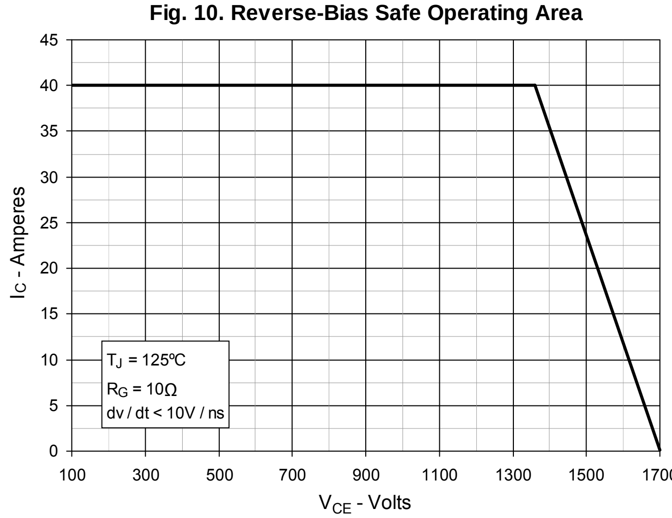



**Fig. 11. Maximum Transient Thermal Impedance (IGBT)**

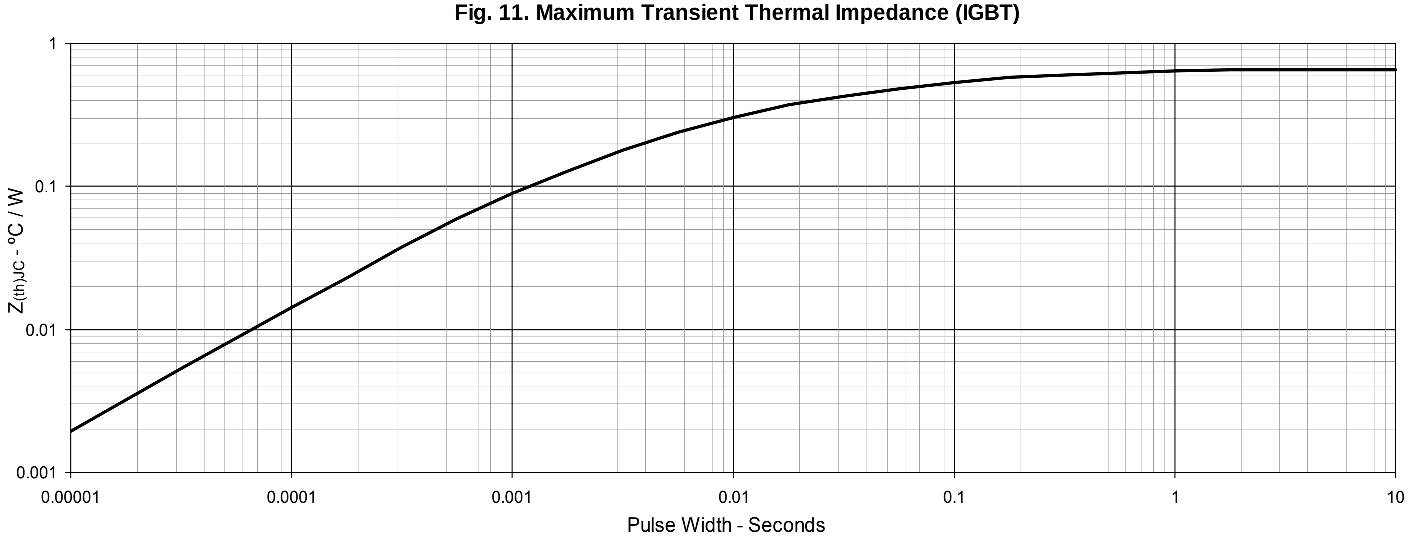


**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**

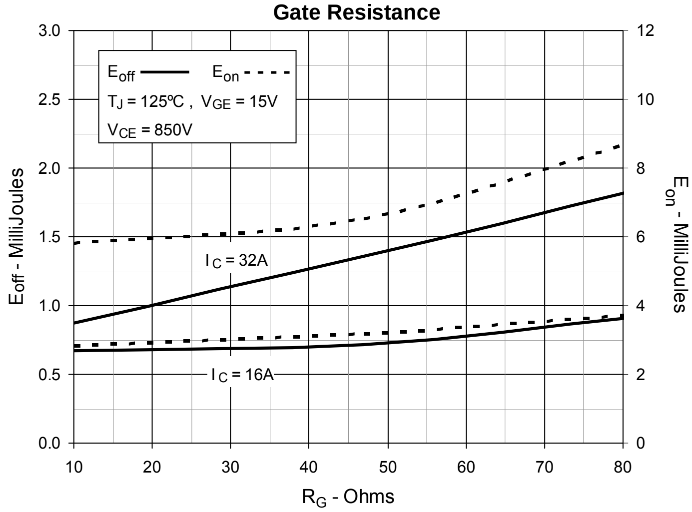



**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**

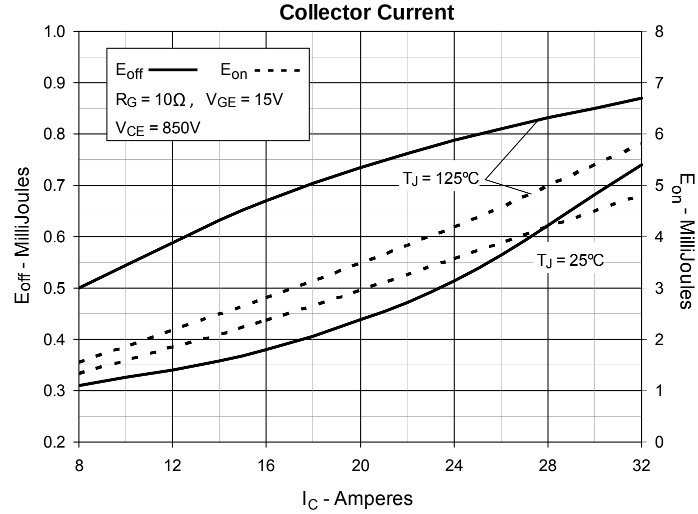



**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**

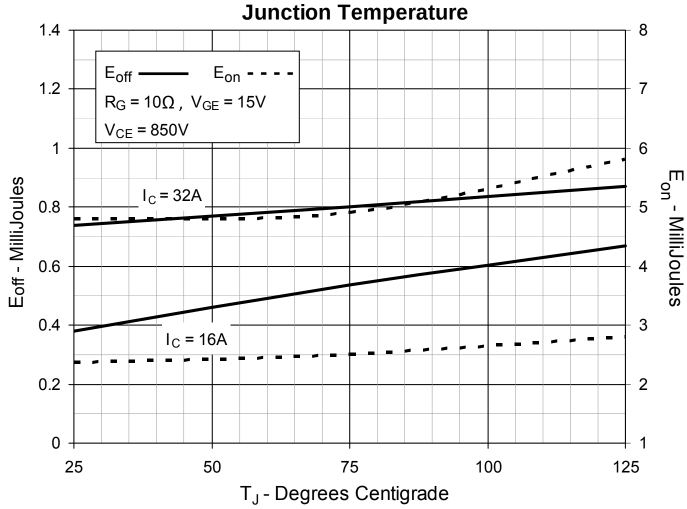



**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**

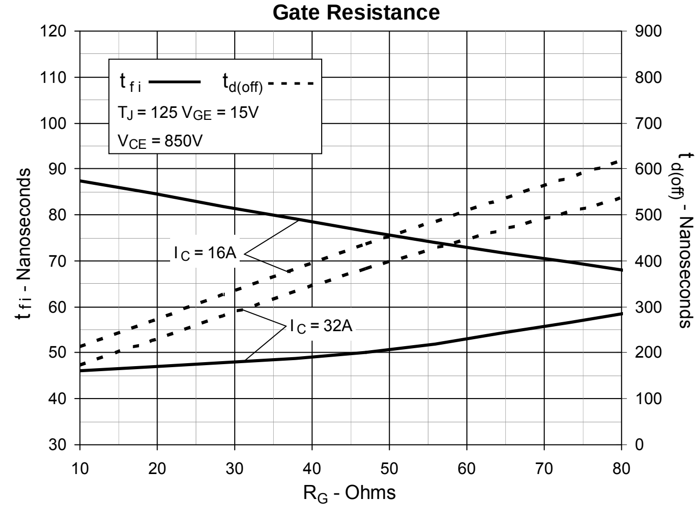



**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**

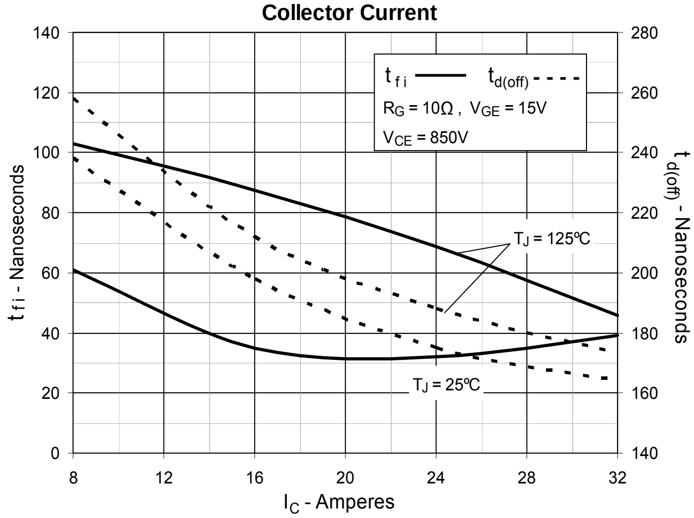



**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**

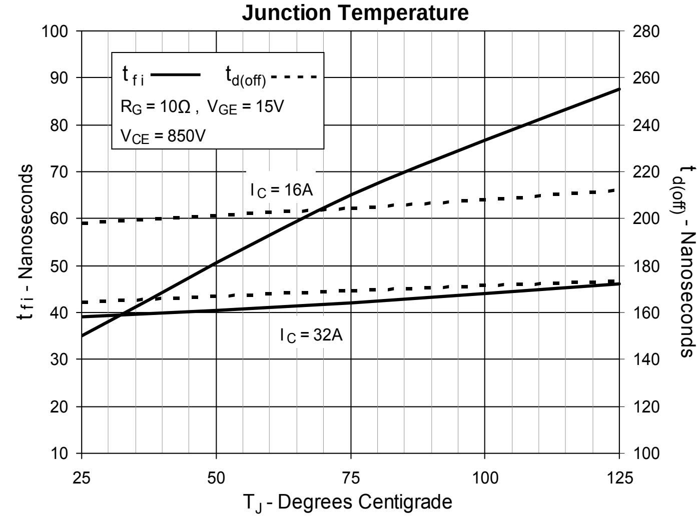


**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**

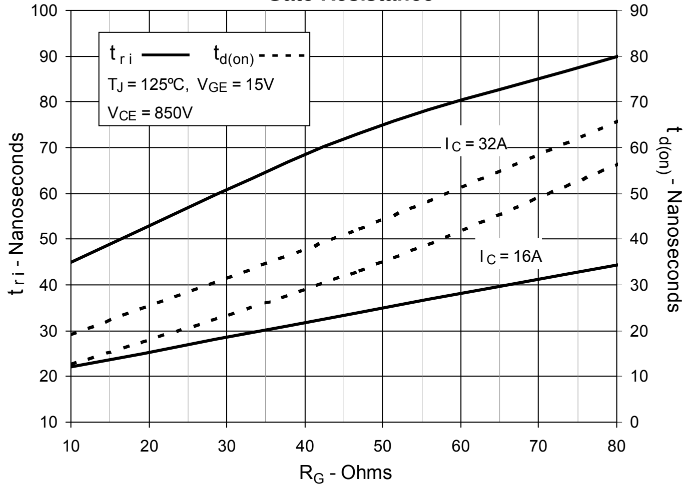



**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**

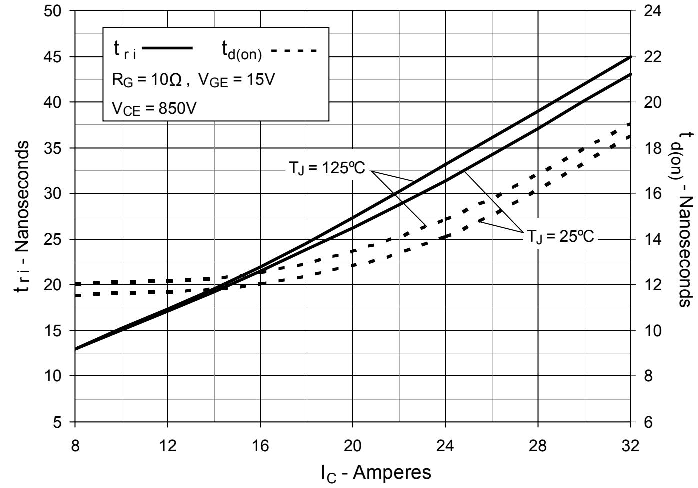



**Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature**

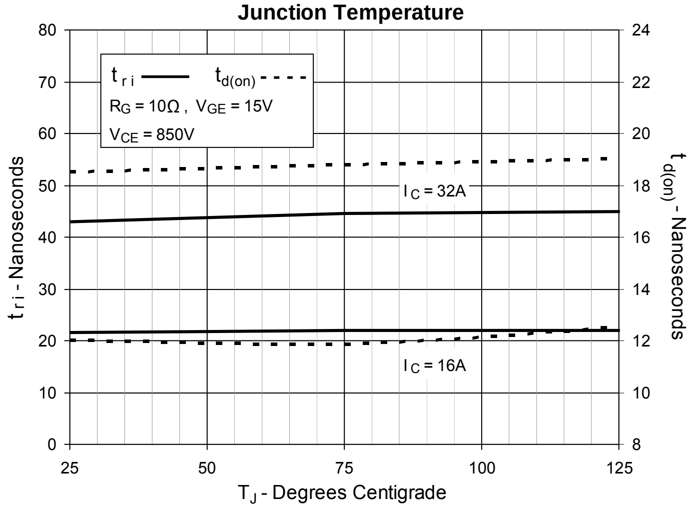


Fig. 21. Forward Current $I_F$ vs $V_F$

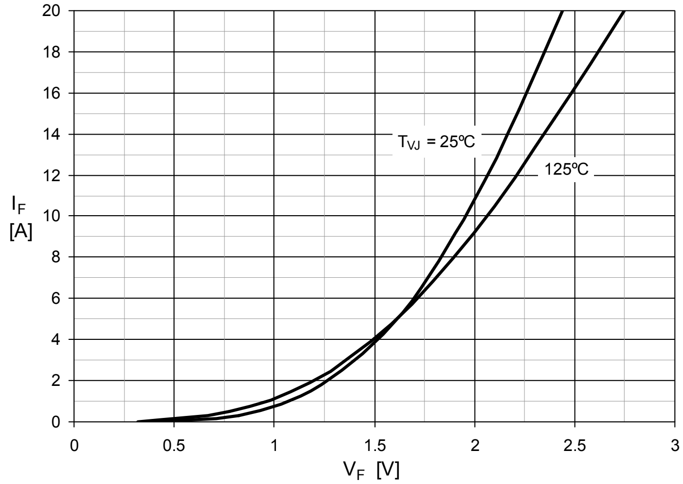



Fig. 22. Reverse Recovery Charge $Q_{rr}$ vs. $-di_F/dt$

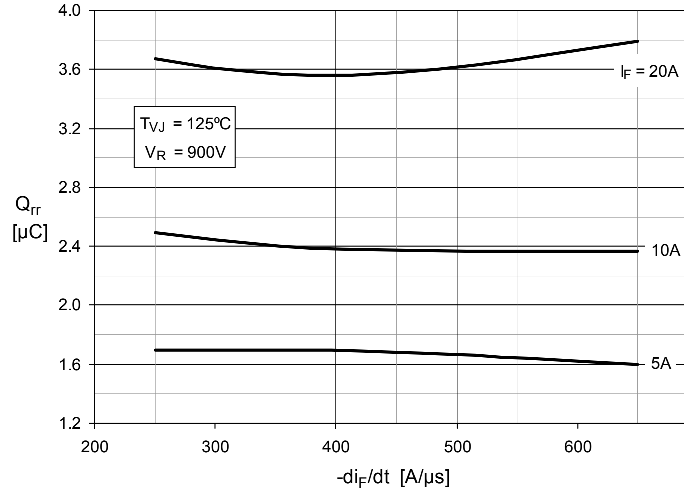



Fig. 23. Peak Reverse Current $I_{RM}$ vs. $-di_F/dt$

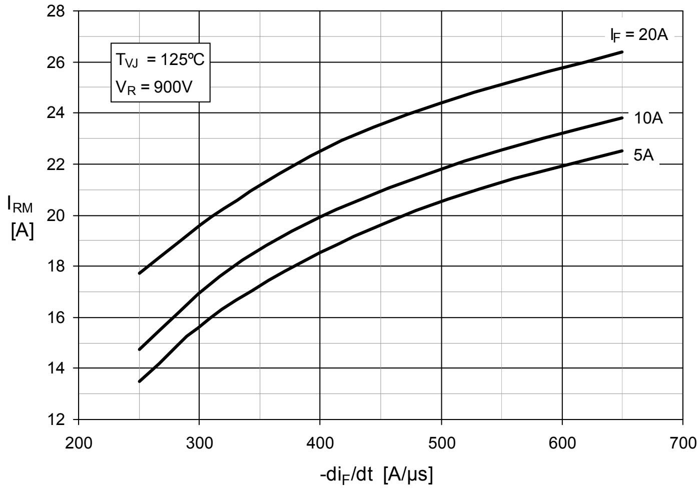



Fig. 24. Recovery Time $t_{rr}$ vs. $-di_F/dt$

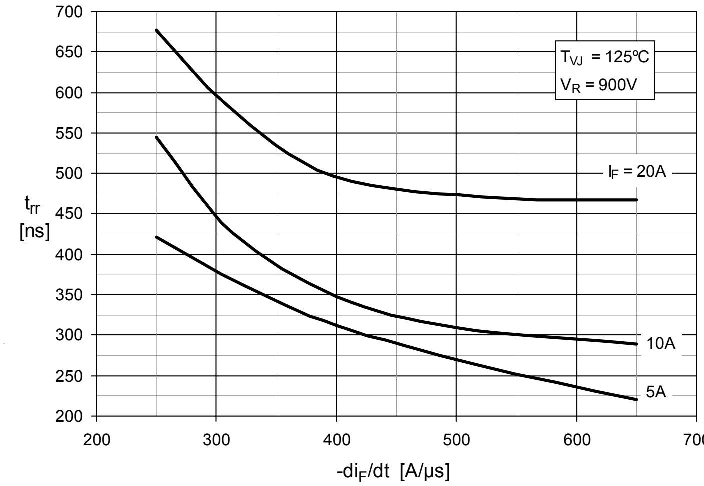



Fig. 25. Recovery Energy $E_{rec}$ vs $-di_F/dt$

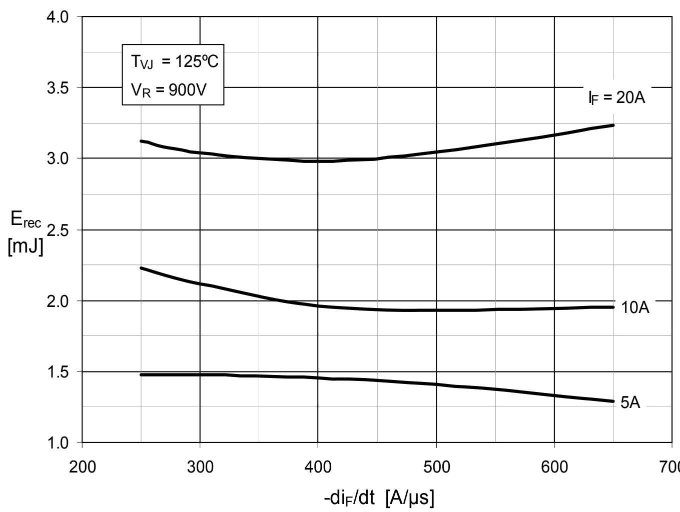



Fig. 26. Maximum Transient Thermal Impedance (Diode)