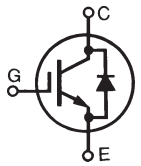
# IXYS

## GenX3™ 600V IGBT with Diode

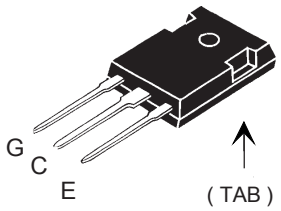
## IXGH48N60C3D1

$V_{CES}$ = 600V
$I_{C110}$ = 48A
$V_{CE(sat)}$ ≤ 2.5V
$t_{fi(typ)}$ = 38ns

**High speed PT IGBT for 40-100kHz Switching**




**TO-247**




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

| 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, $R_{GE}$ = 1MΩ | 600 | V |
| $V_{GES}$ | Continuous | ±20 | V |
| $V_{GEM}$ | Transient | ±30 | V |
| $I_{C25}$ | $T_C$ = 25°C (Limited by Leads) | 75 | A |
| $I_{C110}$ | $T_C$ = 110°C | 48 | A |
| $I_{D110}$ | $T_C$ = 110°C | 30 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1ms | 250 | A |
| $I_A$ | $T_C$ = 25°C | 30 | A |
| $E_{AS}$ | $T_C$ = 25°C | 300 | mJ |
| **SSOA** | $V_{GE}$ = 15V, $T_{VJ}$ = 125°C, $R_G$ = 3Ω | $I_{CM}$ = 100 | A |
| **(RBSOA)** | Clamped Inductive Load | @$V_{CE}$ ≤ 600 | V |
| $P_C$ | $T_C$ = 25°C | 300 | W |
| $T_J$ | | -55 ... +150 | °C |
| $T_{JM}$ | | 150 | °C |
| $T_{stg}$ | | -55 ... +150 | °C |
| $T_L$ | 1.6mm (0.062 in.) from Case for 10s | 300 | °C |
| $T_{SOLD}$ | Plastic Body for 10 Seconds | 260 | °C |
| $F_C$ | Mounting Torque | 1.13/10 | Nm/lb.in |
| **Weight** | | 6 | g |

### Features

- Optimized for Low Switching Losses
- Square RBSOA
- Anti-Parallel Ultra Fast Diode
- Fast Switching
- Avalanche Rated
- International Standard Package

### Advantages

- High Power Density
- Low Gate Drive Requirement

### Applications

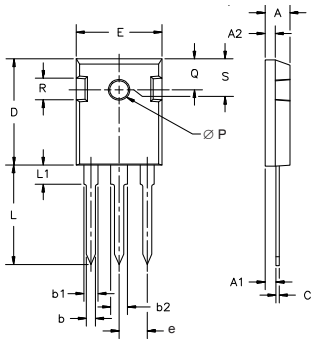
- High Frequency Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts

| Symbol | Test Conditions ($T_J$ = 25°C, Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $V_{GE(th)}$ | $I_C$ = 250μA, $V_{CE}$ = $V_{GE}$ | 3.0 | | 5.5 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$ | | | 300 | μA |
| | $V_{GE}$ = 0V $T_J$ = 125°C | | | 1.75 | mA |
| $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ±20V | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = 30A, $V_{GE}$ = 15V, Note 1 | | 2.3 | 2.5 | V |
| | $T_J$ = 125°C | | 1.8 | | V |

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| Symbol | Test Conditions ($T_J$ = 25°C, Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $g_{fs}$ | $I_C$ = 30A, $V_{CE}$ = 10V, Note 1 | 20 | 30 | | S |
| $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 1960 | | pF |
| $C_{oes}$ | | | 202 | | pF |
| $C_{res}$ | | | 66 | | pF |
| $Q_g$ | $I_C$ = 30A, $V_{GE}$ = 15V, $V_{CE}$ = 0.5 • $V_{CES}$ | | 77 | | nC |
| $Q_{ge}$ | | | 16 | | nC |
| $Q_{gc}$ | | | 32 | | nC |
| $t_{d(on)}$ | **Inductive Load, $T_J$ = 25°C** $I_C$ = 30A, $V_{GE}$ = 15V $V_{CE}$ = 400V, $R_G$ = 3Ω | | 19 | | ns |
| $t_{ri}$ | | | 26 | | ns |
| $E_{on}$ | | | 0.41 | | mJ |
| $t_{d(off)}$ | | | 60 | 100 | ns |
| $t_{fi}$ | | | 38 | | ns |
| $E_{off}$ | | | 0.23 | 0.42 | mJ |
| $t_{d(on)}$ | **Inductive Load, $T_J$ = 125°C** $I_C$ = 30A, $V_{GE}$ = 15V $V_{CE}$ = 400V, $R_G$ = 3Ω | | 19 | | ns |
| $t_{ri}$ | | | 26 | | ns |
| $E_{on}$ | | | 0.65 | | mJ |
| $t_{d(off)}$ | | | 92 | | ns |
| $t_{fi}$ | | | 95 | | ns |
| $E_{off}$ | | | 0.57 | | mJ |
| $R_{thJC}$ | | | | 0.42 | °C/W |
| $R_{thCS}$ | | | 0.21 | | °C/W |

**TO-247 AD Outline**




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

**Reverse Diode (FRED)**

| Symbol | Test Conditions ($T_J$ = 25°C, Unless Otherwise Specified) | | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|---|
| $V_F$ | $I_F$ = 30A, $V_{GE}$ = 0V, Note 1 | | | | 2.7 | V |
| | | $T_J$ = 150°C | | 1.6 | | V |
| $I_{RM}$ | $I_F$ = 30A, $V_{GE}$ = 0V, $-di_F/dt$ = 100A/µs, | $T_J$ = 100°C | | | 4 | A |
| $t_{rr}$ | $V_R$ = 100V | $T_J$ = 100°C | | 100 | | ns |
| | $I_F$ = 1A, $V_{GE}$ = 0V, $-di_F/dt$ = 100A/µs, $V_R$ = 30V | | | 25 | | ns |
| $R_{thJC}$ | | | | | 0.9 | °C/W |

Note 1: Pulse Test, t ≤ 300µs, Duty Cycle, d ≤ 2%.

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

IXYS MOSFETs and IGBTs are covered by one or moreof the following U.S. patents: 4,835,592 4,850,072 4,881,106 4,931,844 5,017,508 5,034,796 5,049,961 5,063,307 5,187,117 5,237,481 5,381,025 5,486,715 6,162,665 6,259,123 B1 6,306,728 B1 6,404,065 B1 6,534,343 6,583,505 6,683,344 6,710,405 B2 6,710,463 6,727,585 6,759,692 6,771,478 B2 7,005,734 B2 7,063,975 B2 7,071,537 7,157,338B2

**Fig. 1. Output Characteristics @ 25ºC**

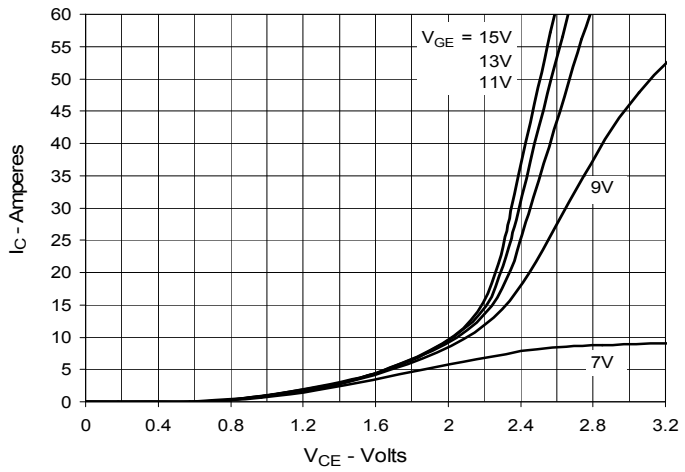



**Fig. 2. Extended Output Characteristics @ 25ºC**

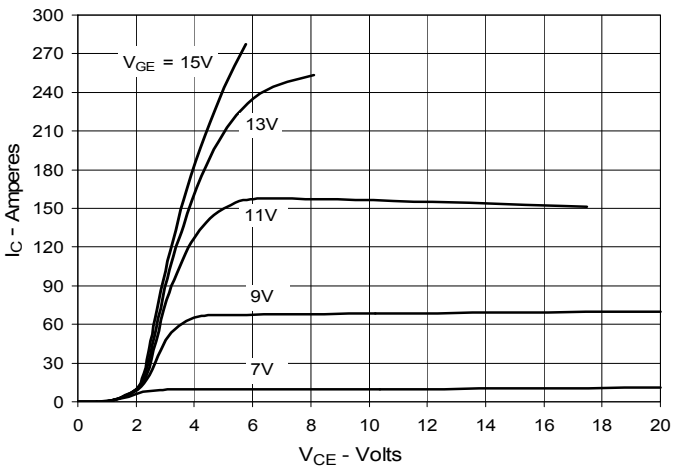



**Fig. 3. Output Characteristics @ 125ºC**

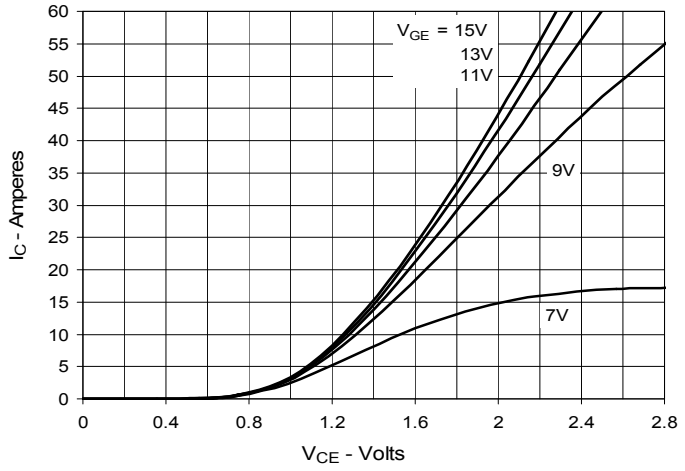



**Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature**

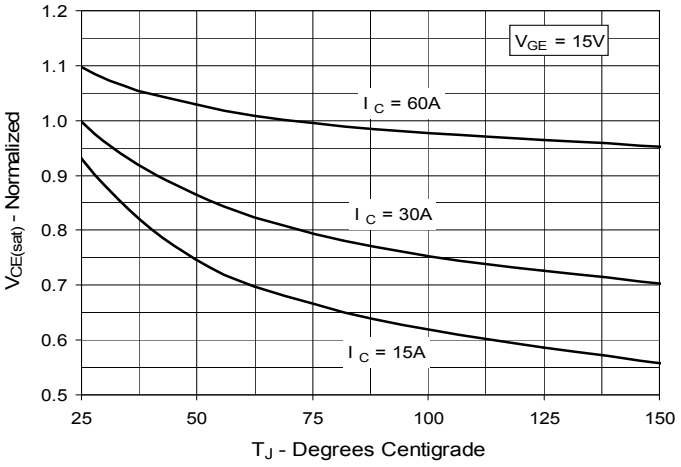



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

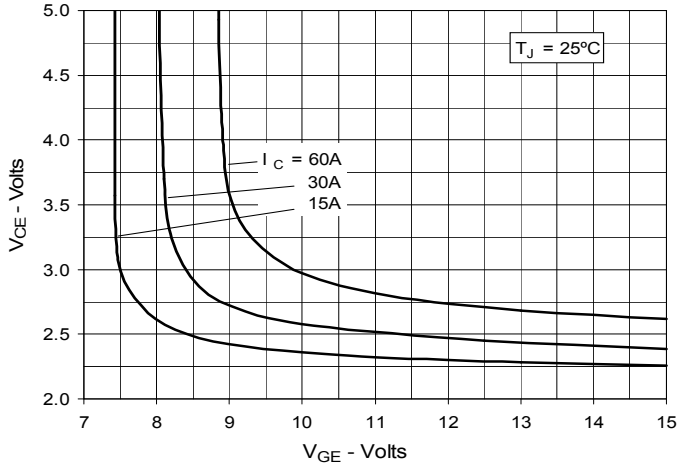
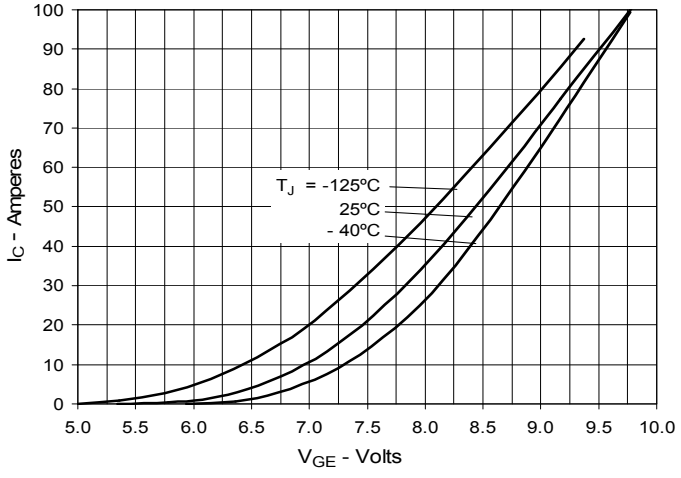



**Fig. 6. Input Admittance**




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**Fig. 7. Transconductance**

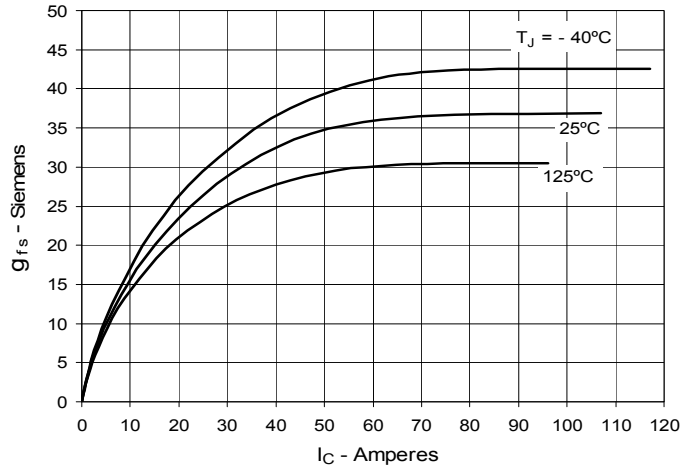



**Fig. 8. Gate Charge**

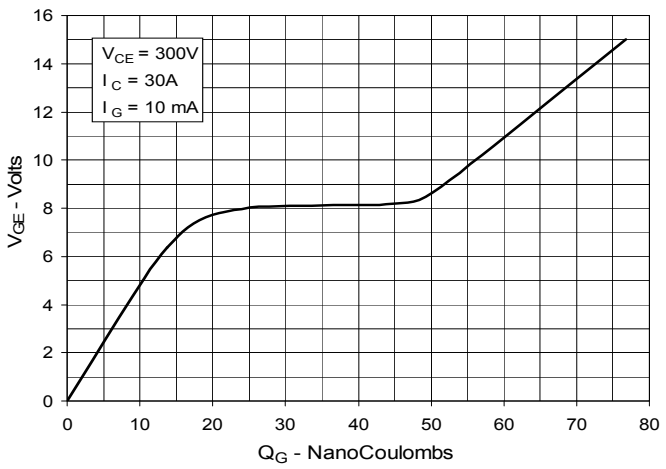



**Fig. 9. Capacitance**

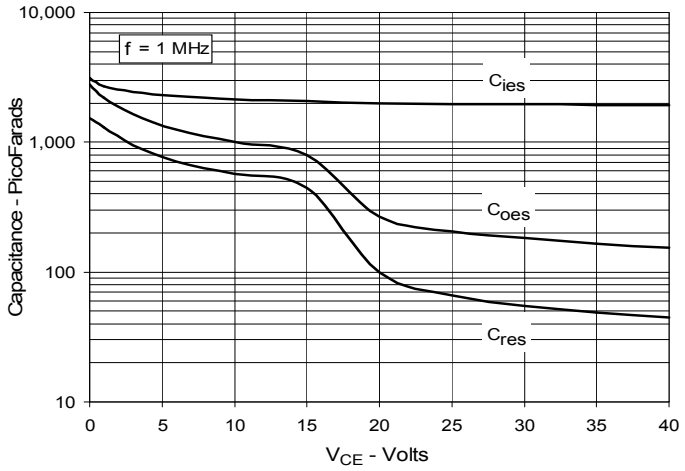



**Fig. 10. Reverse-Bias Safe Operating Area**

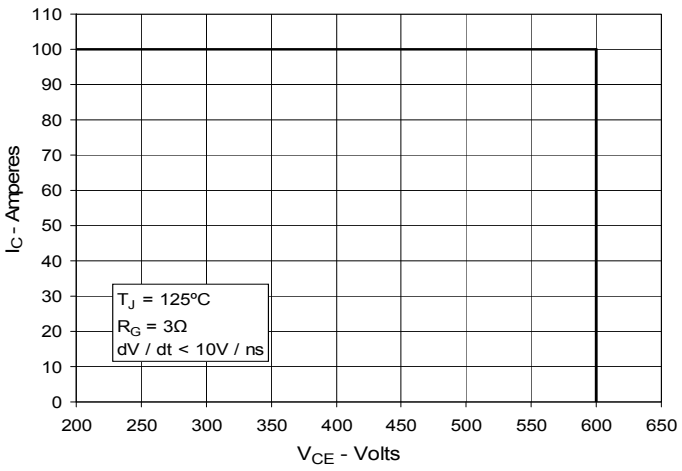
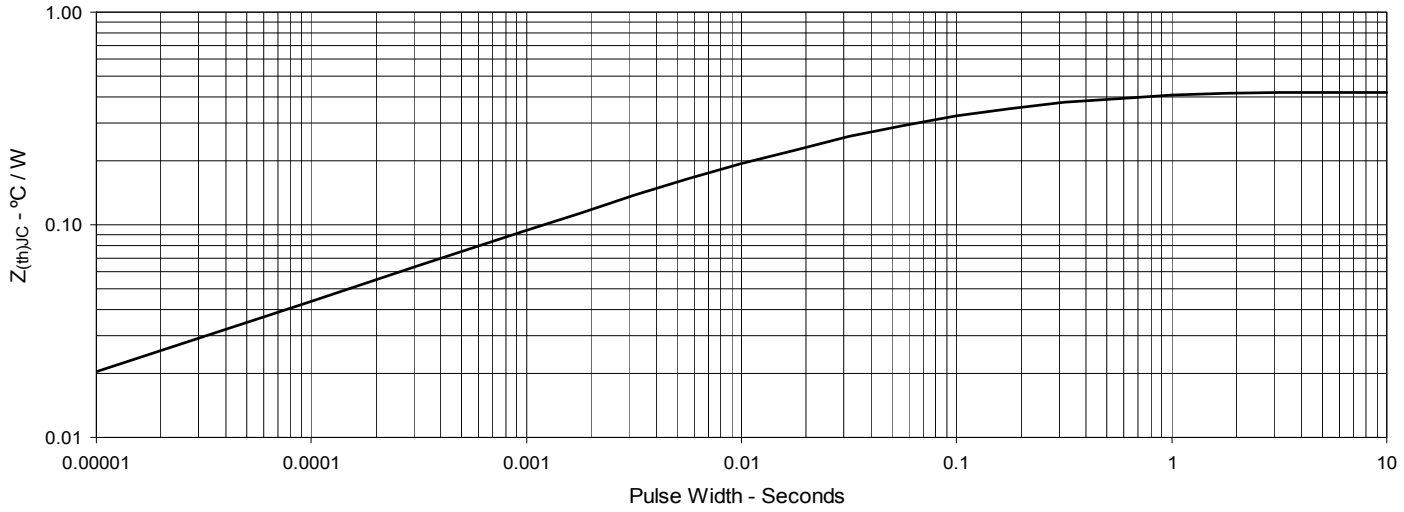



**Fig. 11. Maximum Transient Thermal Impedance**




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

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

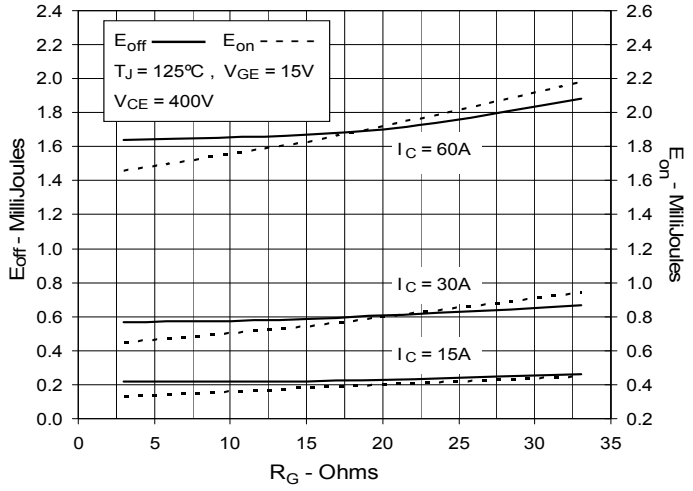



**Fig. 13. Inductive Swiching Energy Loss vs. Collector Current**

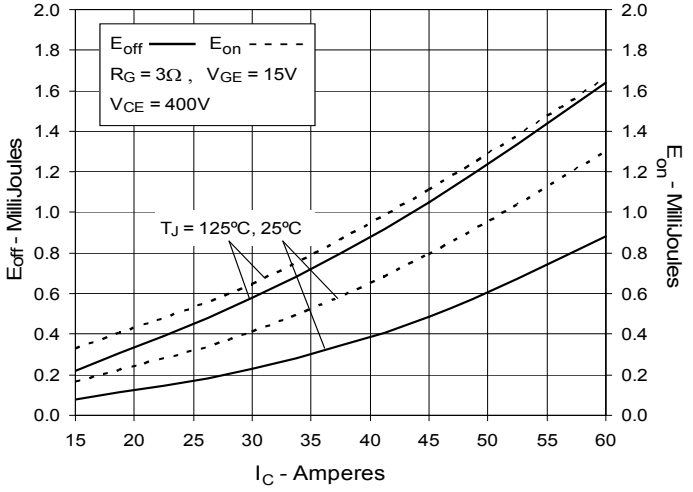



**Fig. 14. Inductive Swiching Energy Loss vs. Junction Temperature**

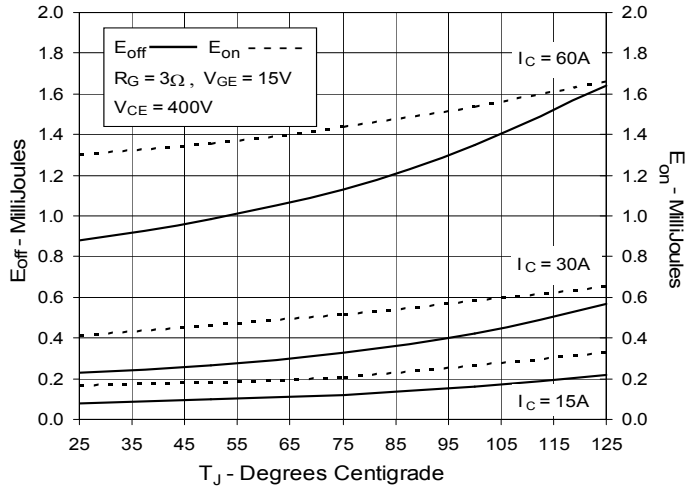



**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**

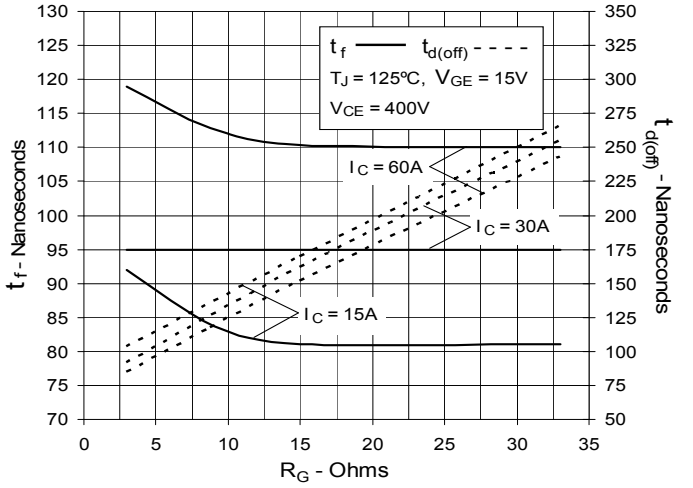



**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**

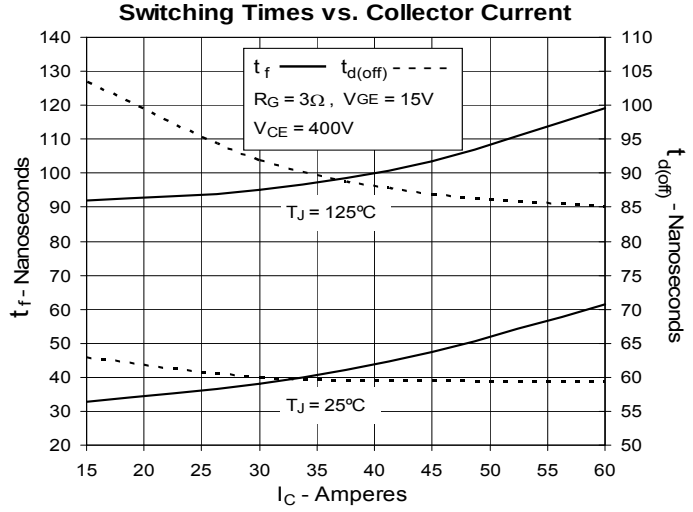
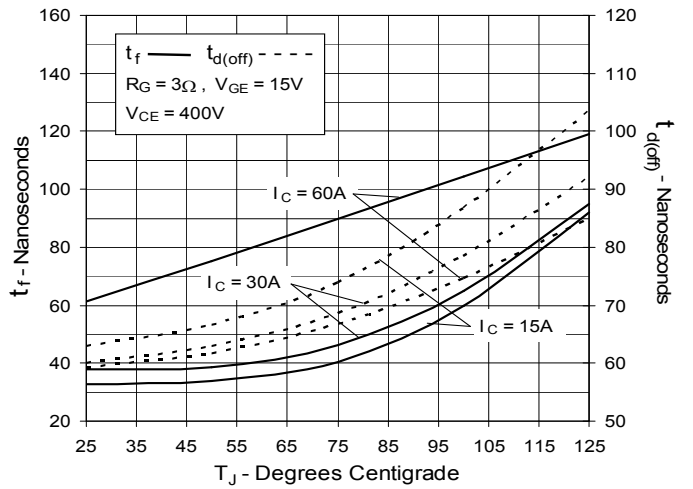



**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**




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

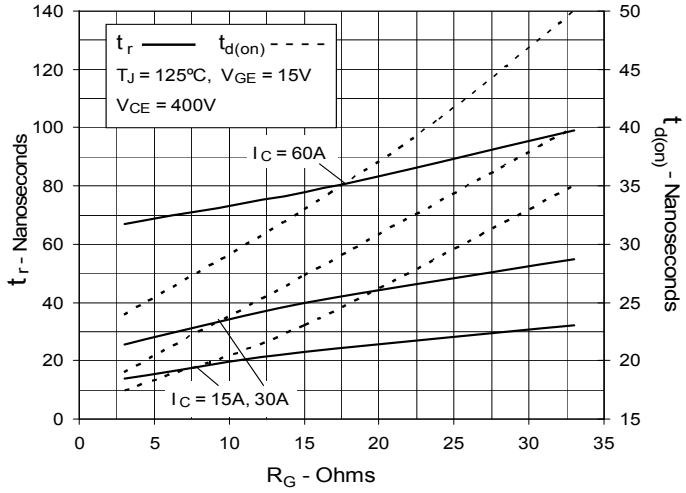



**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**

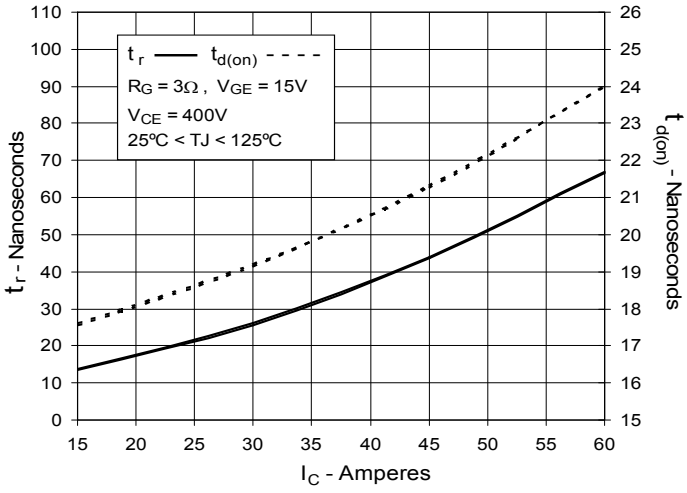
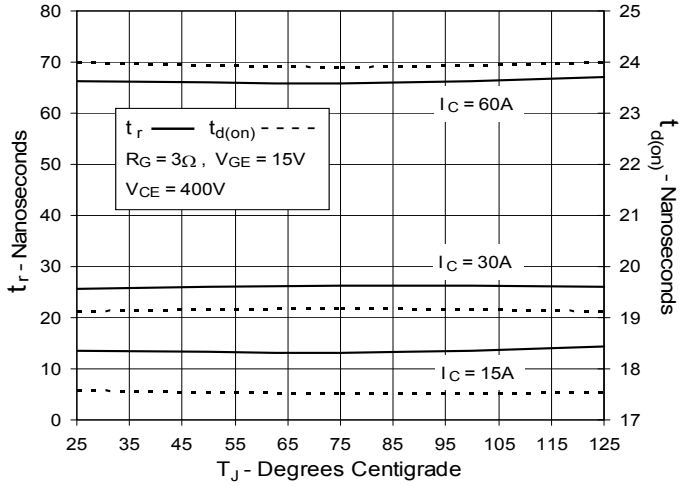



**Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature**




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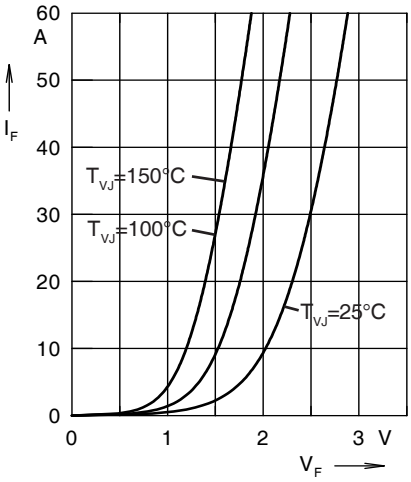



**Fig. 21. Forward current $I_F$ versus $V_F$**

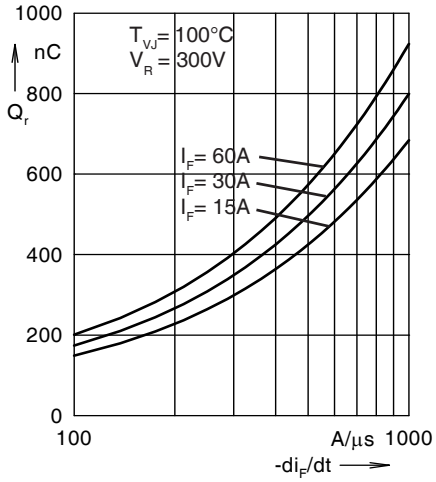



**Fig. 22. Reverse recovery charge $Q_r$ versus -$di_F$/dt**

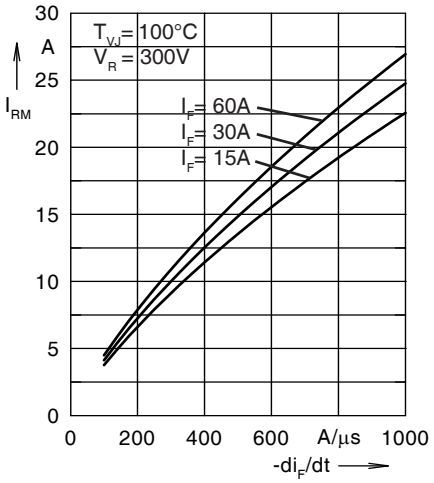



**Fig. 23. Peak reverse current $I_{RM}$ versus -$di_F$/dt**

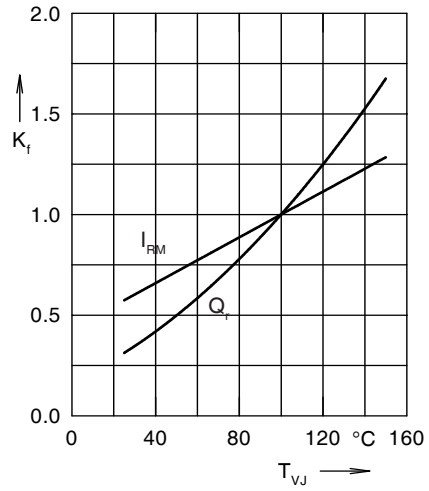



**Fig. 24. Dynamic parameters $Q_r$, $I_{RM}$ versus $T_{VJ}$**

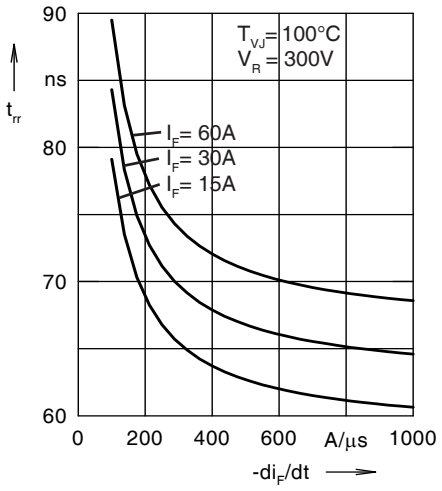



**Fig. 25. Recovery time $t_{rr}$ versus -$di_F$/dt**

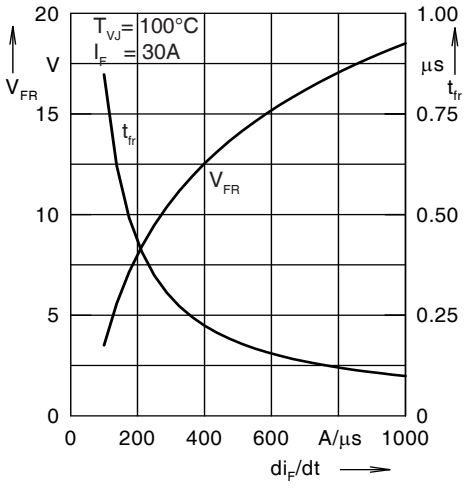



**Fig. 26. Peak forward voltage $V_{FR}$ and $t_{fr}$ versus $di_F$/dt**

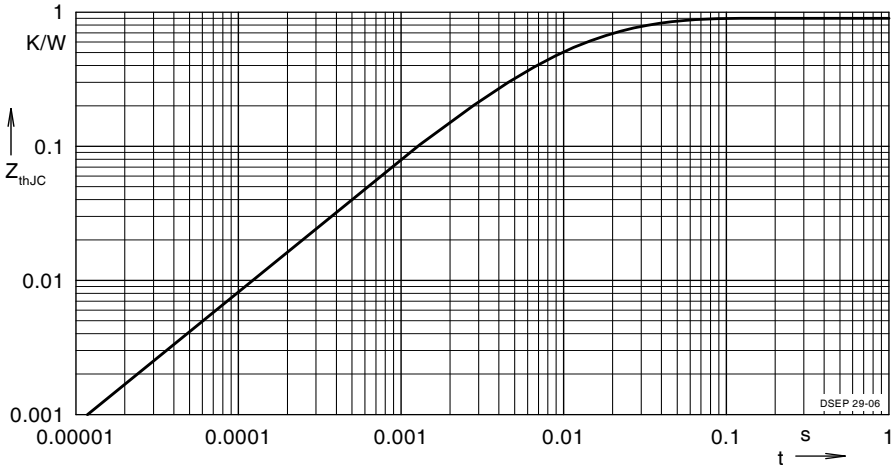



**Fig. 27. Transient thermal resistance junction to case**

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.502 | 0.0052 |
| 2 | 0.193 | 0.0003 |
| 3 | 0.205 | 0.0162 |

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