IXYS

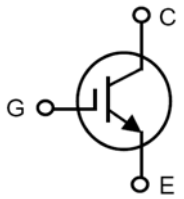
Advance Technical Information

# 1200V XPT™ GenX4™ IGBT

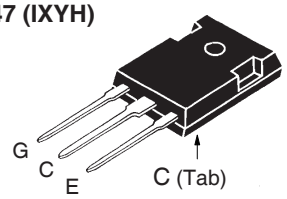
# IXYH40N120C4

$V_{CES}$ = 1200V
$I_{C110}$ = 40A
$V_{CE(sat)}$ ≤ 2.50V
$t_{fi(typ)}$ = 80ns

High Speed IGBT
for 20-50kHz Switching




**TO-247 (IXYH)**




G = Gate C = Collector
E = Emitter Tab = Collector

| Symbol | Test Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_J$ = 25°C to 175°C | 1200 | V |
| $V_{CGR}$ | $T_J$ = 25°C to 175°C, $R_{GE}$ = 1MΩ | 1200 | V |
| $V_{GES}$ | Continuous | ±20 | V |
| $V_{GEM}$ | Transient | ±30 | V |
| $I_{C25}$ | $T_C$ = 25°C | 120 | A |
| $I_{C110}$ | $T_C$ = 110°C | 40 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1ms | 230 | A |
| **SSOA** | $V_{GE}$ = 15V, $T_{VJ}$ = 150°C, $R_G$ = 5Ω | $I_{CM}$ = 80 | A |
| **(RBSOA)** | Clamped Inductive Load | $V_{CE} \leq 0.8 \bullet V_{CES}$ | |
| $P_C$ | $T_C$ = 25°C | 680 | W |
| $T_J$ | | -55 ... +175 | °C |
| $T_{JM}$ | | 175 | °C |
| $T_{stg}$ | | -55 ... +175 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering | 300 | °C |
| $T_{SOLD}$ | 1.6 mm (0.062in.) from Case for 10s | 260 | °C |
| $M_d$ | Mounting Torque | 1.13 / 10 | Nm/lb.in |
| **Weight** | | 6 | g |

| Symbol | Test Conditions ($T_J$ = 25°C, Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $BV_{CES}$ | $I_C$ = 250μA, $V_{GE}$ = 0V | 1200 | | | V |
| $V_{GE(th)}$ | $I_C$ = 250μA, $V_{CE}$ = $V_{GE}$ | 4.0 | | 6.5 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0V | | | 10 | μA |
| | $T_J$ = 150°C | | | 750 | μA |
| $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ±20V | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = 32A, $V_{GE}$ = 15V, Note 1 | | 2.05 | 2.50 | V |
| | $T_J$ = 150°C | | 2.50 | | V |

## Features

- Optimized for Low Switching Losses
- Positive Thermal Coefficient of Vce(sat)
- International Standard Package

## Advantages

- High Power Density
- Low Gate Drive Requirement

## Applications

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

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| Symbol | Test Conditions ($T_J$ = 25°C Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. |
|---|---|---|---|---|
| $g_{fs}$ | $I_C$ = 32A, $V_{CE}$ = 10V, Note 1 | 13 | 22 | S |
| $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 1665 | pF |
| $C_{oes}$ | | | 105 | pF |
| $C_{res}$ | | | 63 | pF |
| $Q_{g(on)}$ | $I_C$ = 32A, $V_{GE}$ = 15V, $V_{CE}$ = 0.5 • $V_{CES}$ | | 92 | nC |
| $Q_{ge}$ | | | 11 | nC |
| $Q_{gc}$ | | | 37 | nC |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 25°C** | | 21 | ns |
| $t_{ri}$ | $I_C$ = 32A, $V_{GE}$ = 15V | | 55 | ns |
| $E_{on}$ | $V_{CE}$ = 0.8 • $V_{CES}$, $R_G$ = 5Ω | | 5.55 | mJ |
| $t_{d(off)}$ | Note 2 | | 140 | ns |
| $t_{fi}$ | | | 80 | ns |
| $E_{off}$ | | | 1.55 | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 125°C** | | 18 | ns |
| $t_{ri}$ | $I_C$ = 32A, $V_{GE}$ = 15V | | 45 | ns |
| $E_{on}$ | $V_{CE}$ = 0.8 • $V_{CES}$, $R_G$ = 5Ω | | 7.80 | mJ |
| $t_{d(off)}$ | Note 2 | | 190 | ns |
| $t_{fi}$ | | | 80 | ns |
| $E_{off}$ | | | 2.65 | mJ |
| $R_{thJC}$ | | | | 0.22 °C/W |
| $R_{thCS}$ | | | 0.21 | °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 $R_G$.

**ADVANCE TECHNICAL INFORMATION**

The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents: 4,835,592 4,860,072 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 @ $T_J$ = 25°C**

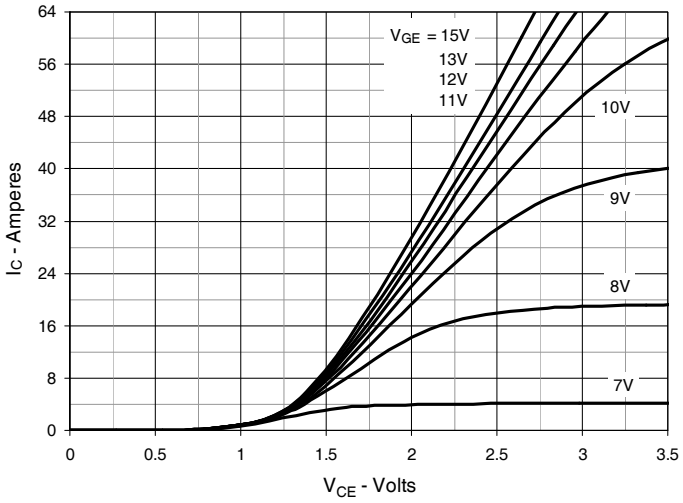



**Fig. 2. Extended Output Characteristics @ $T_J$ = 25°C**

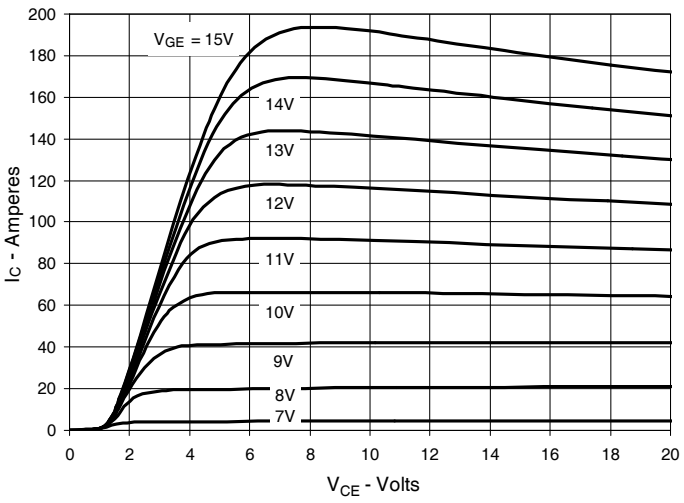



**Fig. 3. Output Characteristics @ $T_J$ = 150°C**

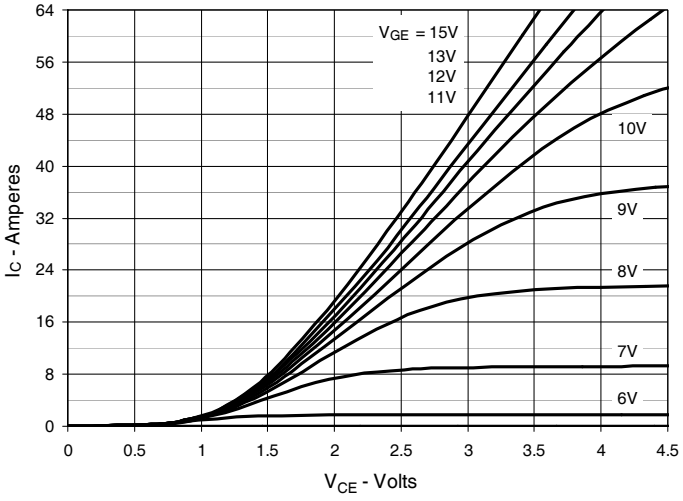



**Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature**

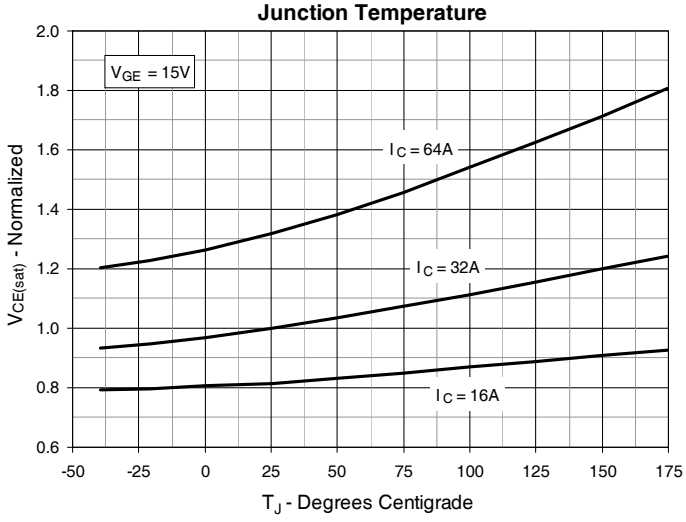



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

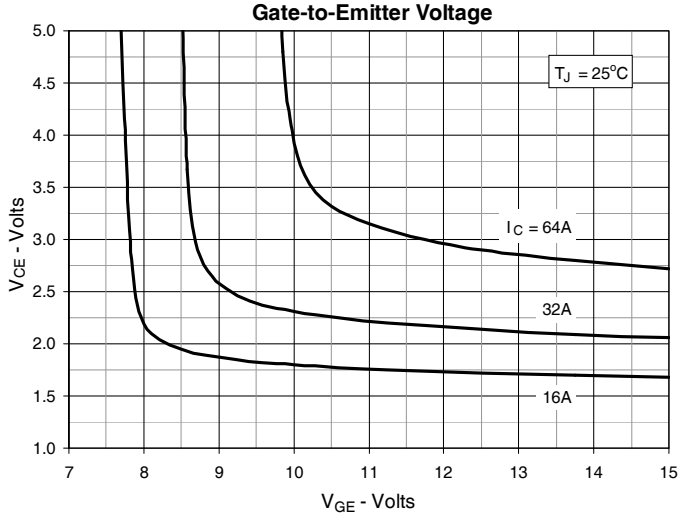
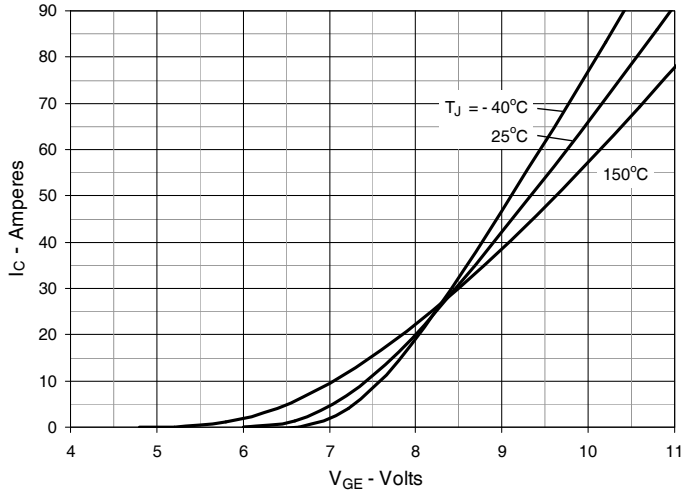



**Fig. 6. Input Admittance**




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**Fig. 7. Transconductance**

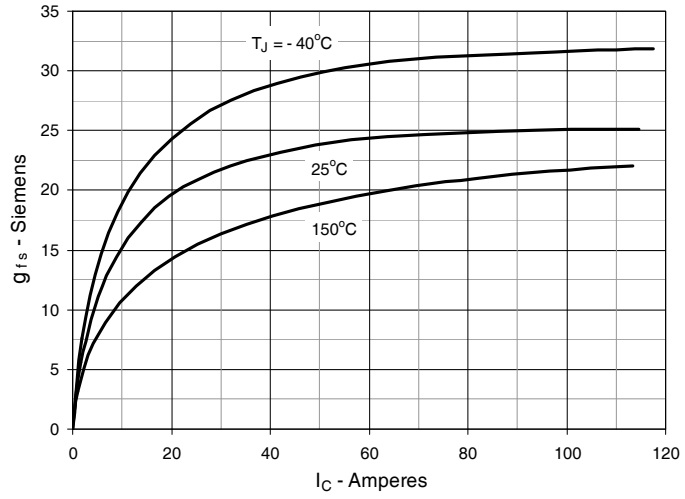



**Fig. 8. Gate Charge**

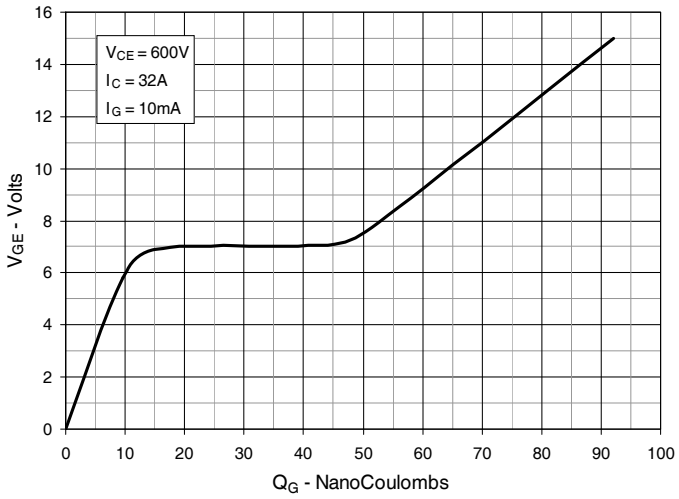



**Fig. 9. Capacitance**

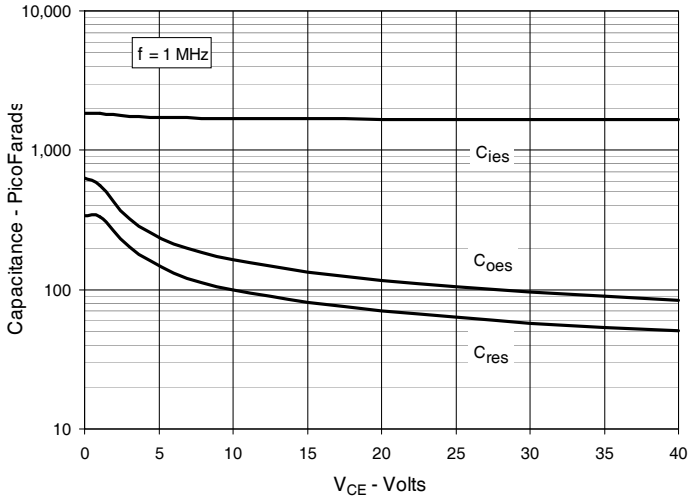



**Fig. 10. Reverse-Bias Safe Operating Area**

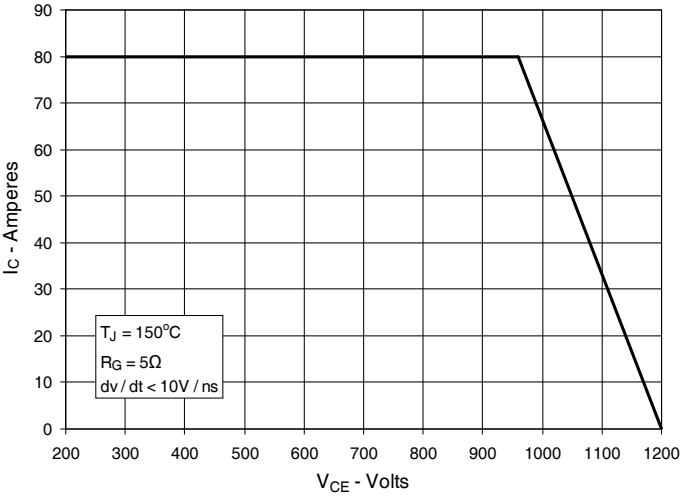
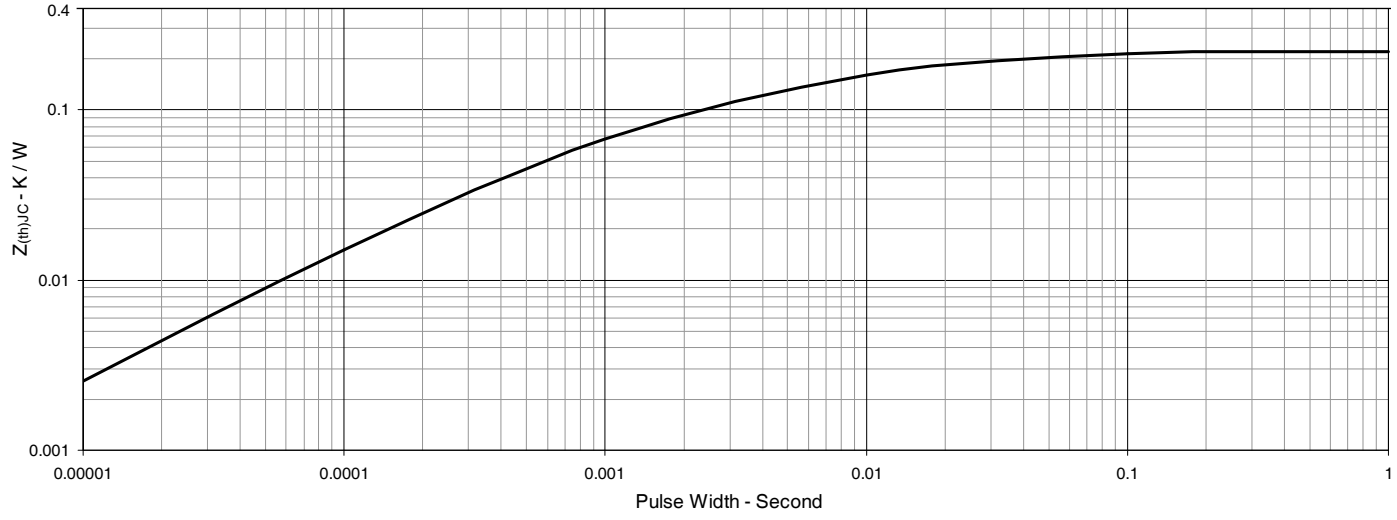



**Fig. 11. Maximum Transient Thermal Impedance**




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

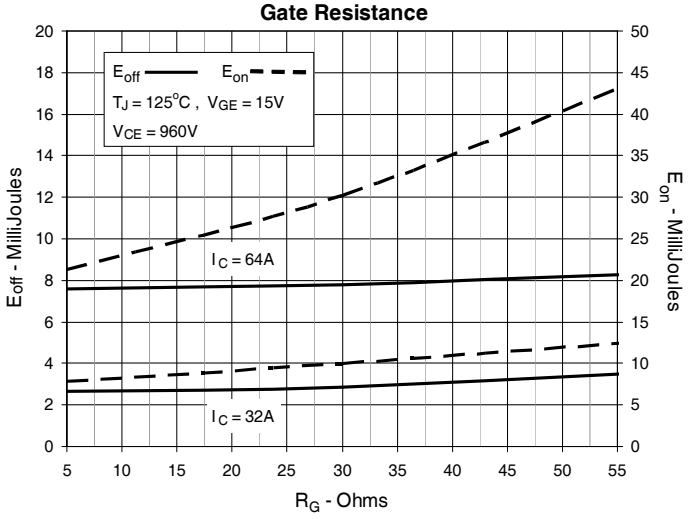



**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**

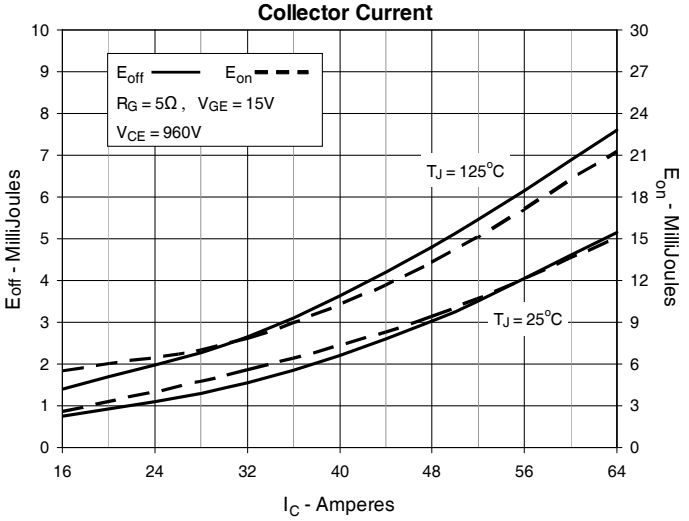



**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**

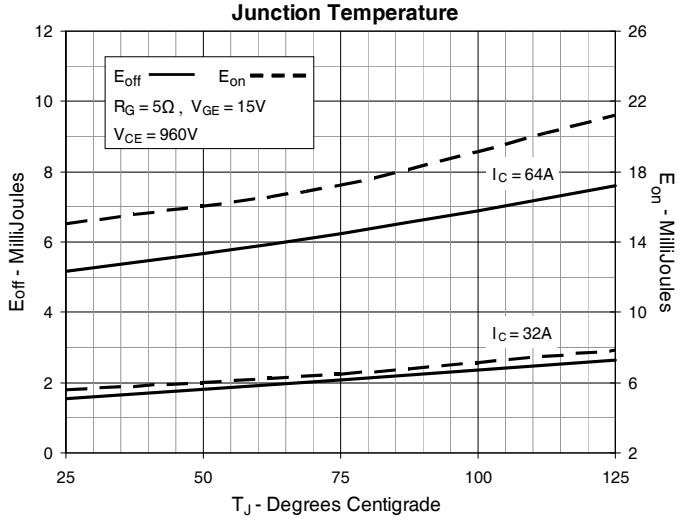



**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**

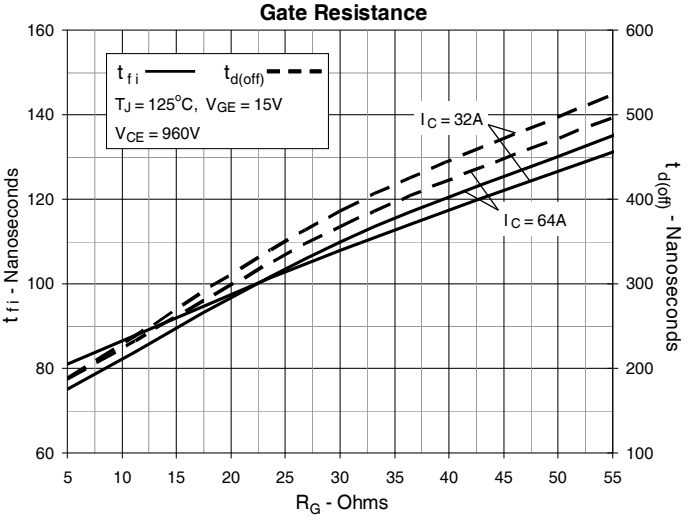



**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**

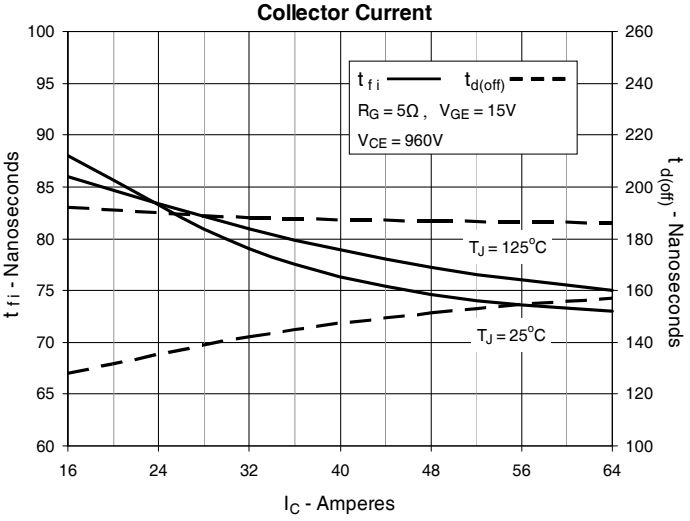
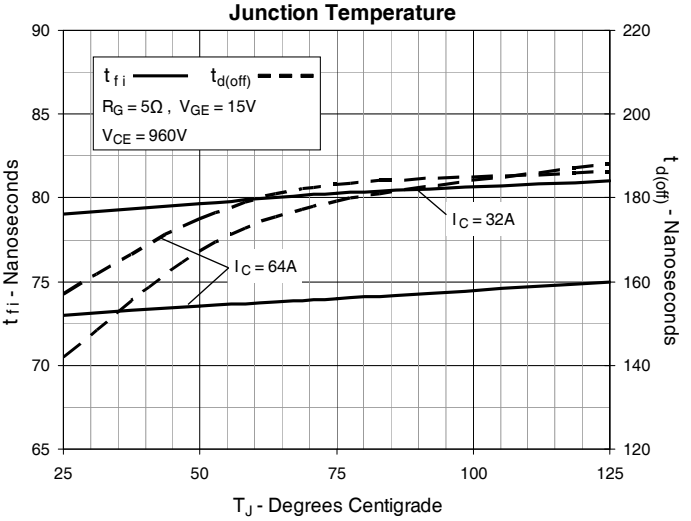



**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**




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

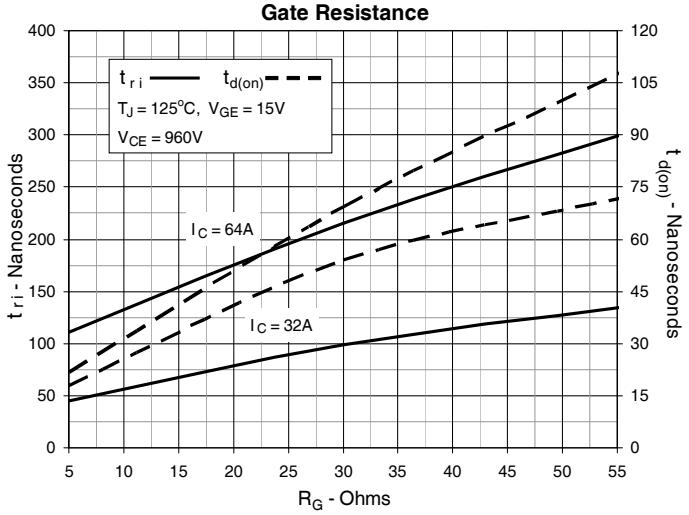



**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**

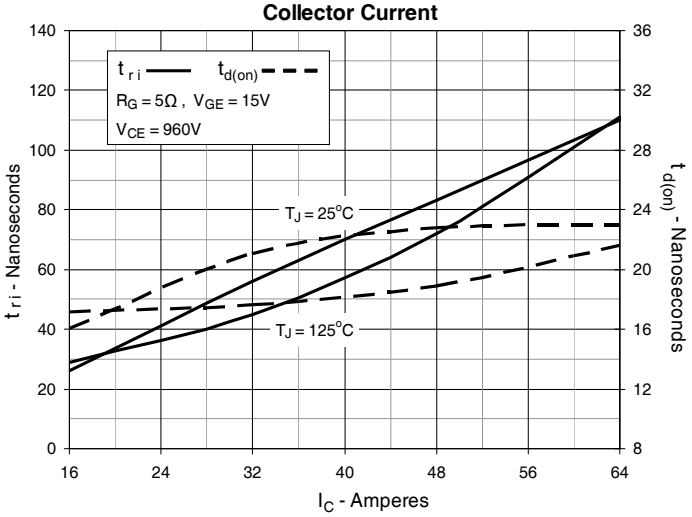
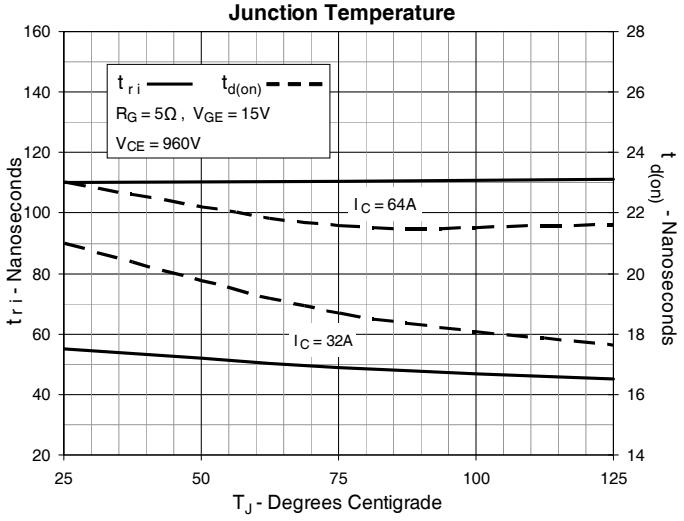
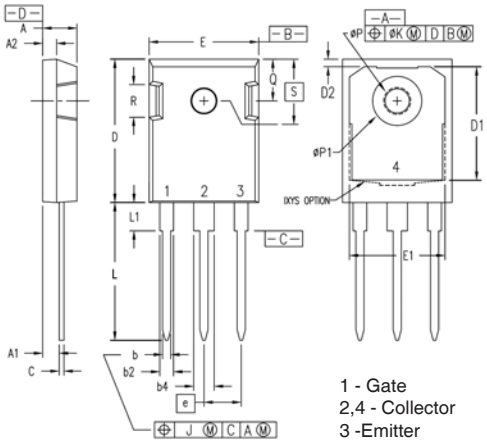



**Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature**




**TO-247 (IXYH) Outline**




| SYM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | .190 | .205 | 4.83 | 5.21 |
| A1 | .090 | .100 | 2.29 | 2.54 |
| A2 | .075 | .085 | 1.91 | 2.16 |
| b | .045 | .055 | 1.14 | 1.40 |
| b2 | .075 | .087 | 1.91 | 2.20 |
| b4 | .115 | .126 | 2.92 | 3.20 |
| C | .024 | .031 | 0.61 | 0.80 |
| D | .819 | .840 | 20.80 | 21.34 |
| D1 | .650 | .690 | 16.51 | 17.53 |
| D2 | .035 | .050 | 0.89 | 1.27 |
| E | .620 | .635 | 15.75 | 16.13 |
| E1 | .545 | .565 | 13.84 | 14.35 |
| e | .215 BSC | | 5.45 BSC | |
| J | -- | .010 | -- | 0.25 |
| K | -- | .025 | -- | 0.64 |
| L | .780 | .810 | 19.81 | 20.57 |
| L1 | .150 | .170 | 3.81 | 4.32 |
| øP | .140 | .144 | 3.55 | 3.65 |
| øP1 | .275 | .290 | 6.99 | 7.37 |
| Q | .220 | .244 | 5.59 | 6.20 |
| R | .170 | .190 | 4.32 | 4.83 |
| S | .242 BSC | | 6.15 BSC | |

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