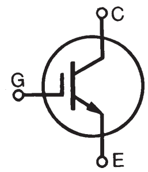
# XPT™ 650V IGBT GenX3™

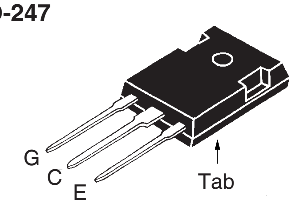
# IXYH120N65B3

$V_{CES}$ = 650V
$I_{C110}$ = 120A
$V_{CE(sat)}$ ≤ 1.90V
$t_{fi(typ)}$ = 107ns

Extreme Light Punch Through IGBT for 10-30kHz Switching




**TO-247**




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

| Symbol | Test Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_J$ = 25°C to 175°C | 650 | V |
| $V_{CGR}$ | $T_J$ = 25°C to 175°C, $R_{GE}$ = 1MΩ | 650 | V |
| $V_{GES}$ | Continuous | ±20 | V |
| $V_{GEM}$ | Transient | ±30 | V |
| $I_{C25}$ | $T_C$ = 25°C (Chip Capability) | 340 | A |
| $I_{LRMS}$ | Terminal Current Limit | 160 | A |
| $I_{C110}$ | $T_C$ = 110°C | 120 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1ms | 770 | A |
| $I_A$ | $T_C$ = 25°C | 60 | A |
| $E_{AS}$ | $T_C$ = 25°C | 1 | J |
| **SSOA (RBSOA)** | $V_{GE}$ = 15V, $T_{VJ}$ = 150°C, $R_G$ = 2Ω Clamped Inductive Load | $I_{CM}$ = 240 $V_{CE} \leq V_{CES}$ | A |
| $t_{sc}$ **(SCSOA)** | $V_{GE}$ = 15V, $V_{CE}$ = 400V, $T_J$ = 150°C $R_G$ = 82Ω, Non Repetitive | 8 | µs |
| $P_C$ | $T_C$ = 25°C | 1360 | 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 | 650 | | | V |
| $V_{GE(th)}$ | $I_C$ = 250µA, $V_{CE}$ = $V_{GE}$ | 3.5 | | 6.0 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0V | | | 25 | µA |
| | $T_J$ = 150°C | | | 1 | mA |
| $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ±20V | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = 100A, $V_{GE}$ = 15V, Note 1 | | 1.55 | 1.90 | V |
| | $T_J$ = 150°C | | 1.77 | | V |

## Features

- Optimized for 10-30kHz Switching
- Square RBSOA
- Avalanche Rated
- Short Circuit Capability
- High Current Handling Capability
- 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

| Symbol | Test Conditions ($T_J$ = 25°C Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. |
|---|---|---|---|---|
| $g_{fs}$ | $I_C$ = 60A, $V_{CE}$ = 10V, Note 1 | 35 | 58 | S |
| $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 6900 | pF |
| $C_{oes}$ | | | 393 | pF |
| $C_{res}$ | | | 146 | pF |
| $Q_{g(on)}$ | $I_C$ = 120A, $V_{GE}$ = 15V, $V_{CE}$ = 0.5 • $V_{CES}$ | | 250 | nC |
| $Q_{ge}$ | | | 52 | nC |
| $Q_{gc}$ | | | 110 | nC |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 25°C** | | 30 | ns |
| $t_{ri}$ | $I_C$ = 50A, $V_{GE}$ = 15V | | 28 | ns |
| $E_{on}$ | $V_{CE}$ = 400V, $R_G$ = 2Ω | | 1.34 | mJ |
| $t_{d(off)}$ | Note 2 | | 168 | ns |
| $t_{fi}$ | | | 107 | ns |
| $E_{off}$ | | | 1.50 | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 150°C** | | 30 | ns |
| $t_{ri}$ | $I_C$ = 50A, $V_{GE}$ = 15V | | 30 | ns |
| $E_{on}$ | $V_{CE}$ = 400V, $R_G$ = 2Ω | | 2.60 | mJ |
| $t_{d(off)}$ | Note 2 | | 226 | ns |
| $t_{fi}$ | | | 196 | ns |
| $E_{off}$ | | | 2.20 | mJ |
| $R_{thJC}$ | | | | 0.11 °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 $R_G$.

**PRELIMINARY 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.

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

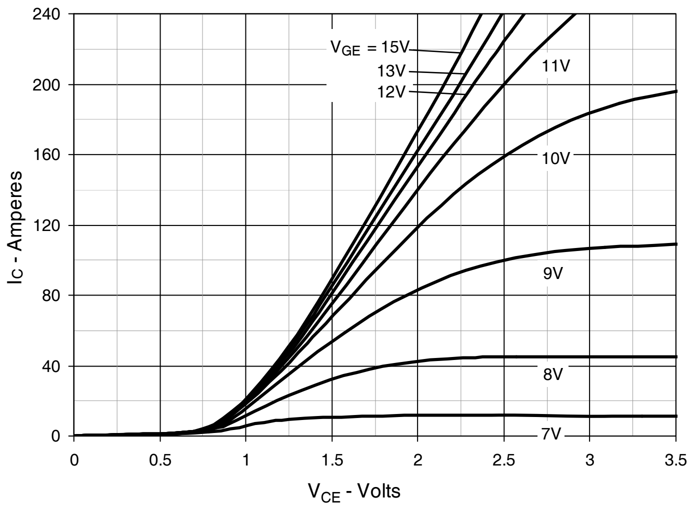



**Fig. 2. Extended Output Characteristics @ $T_J = 25^oC$**

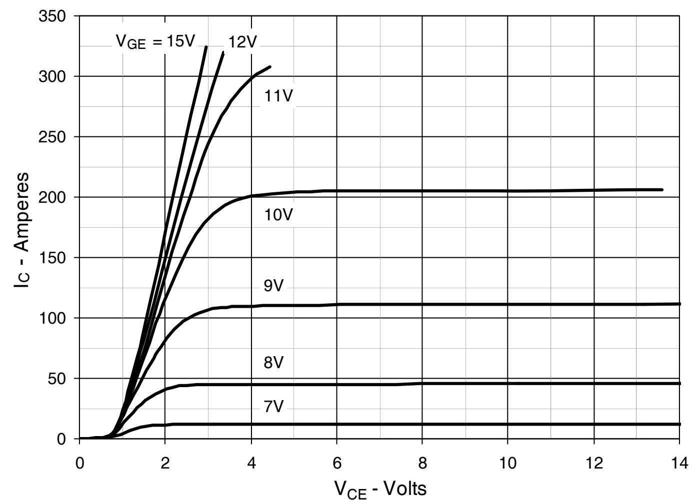



**Fig. 3. Output Characteristics @ $T_J = 150^oC$**

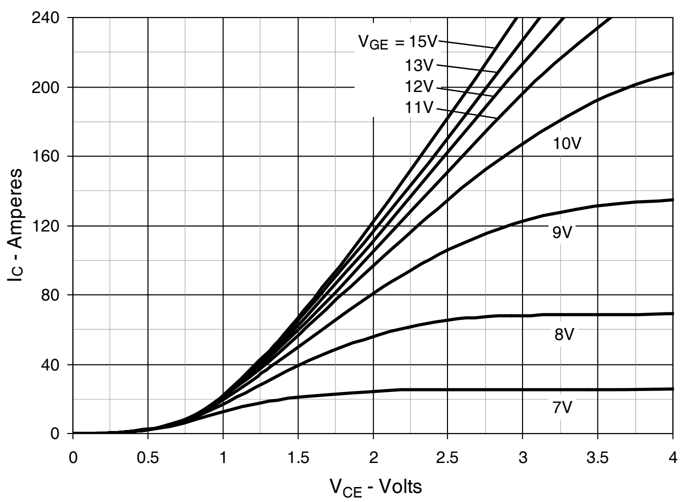



**Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature**

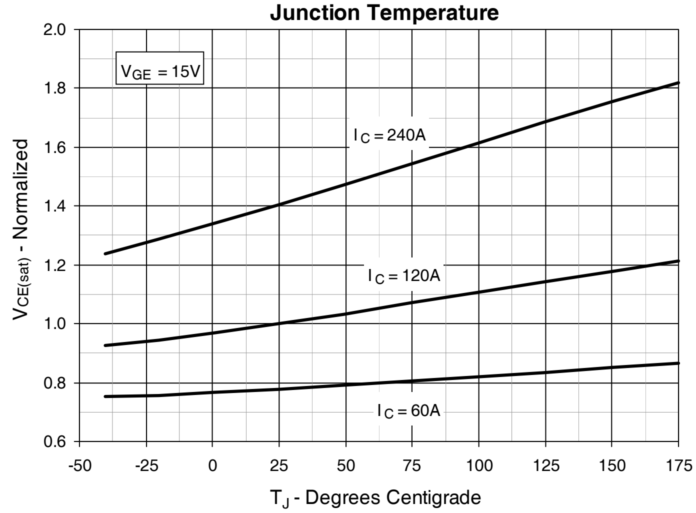



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

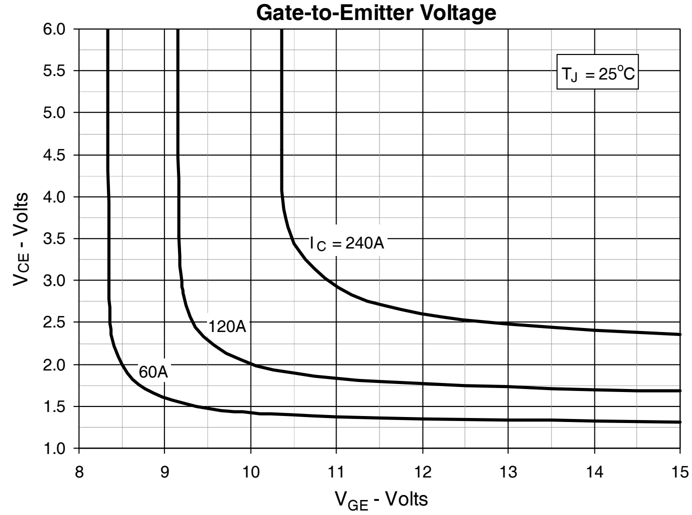



**Fig. 6. Input Admittance**

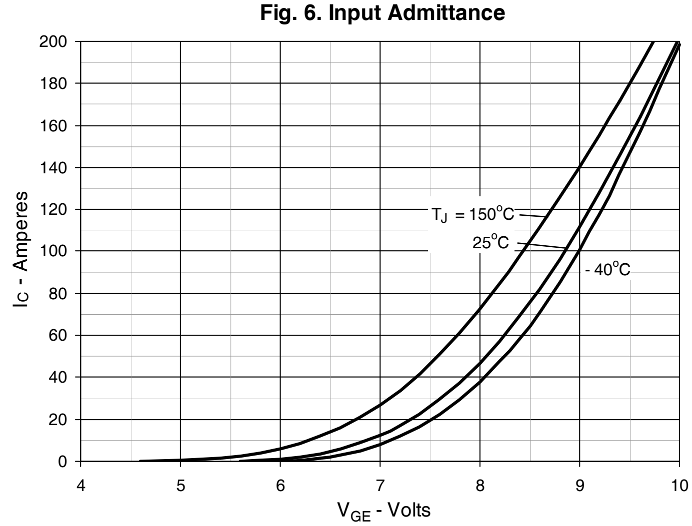


**Fig. 7. Transconductance**

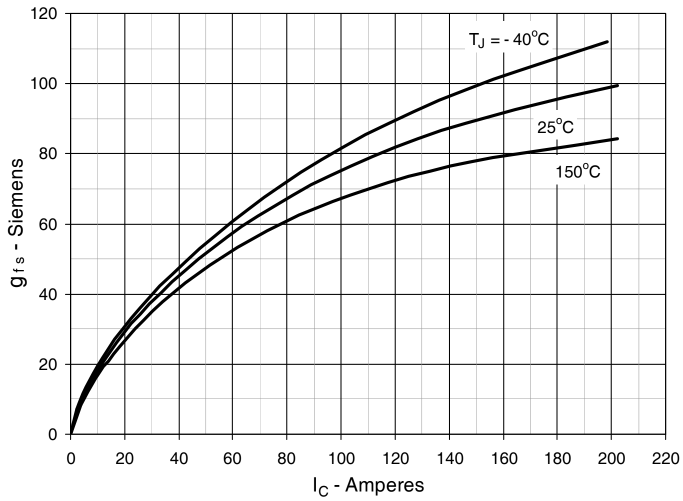



**Fig. 8. Gate Charge**

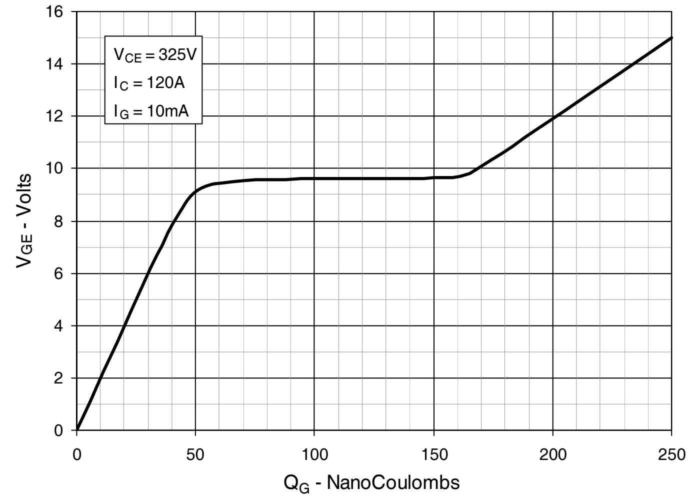



**Fig. 9. Capacitance**

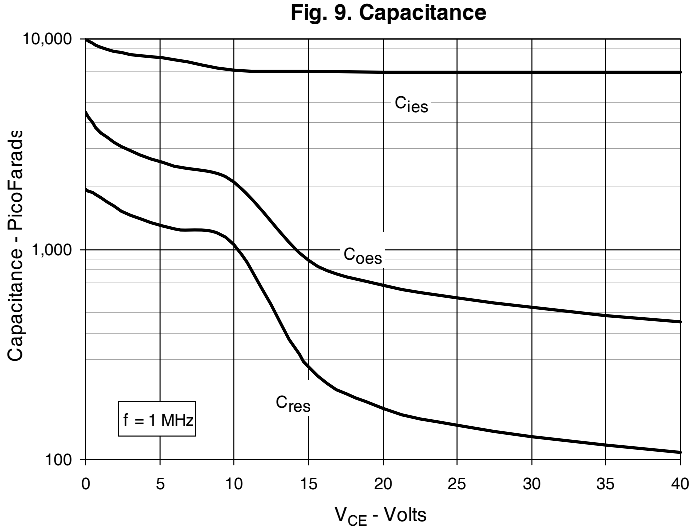



**Fig. 10. Reverse-Bias Safe Operating Area**

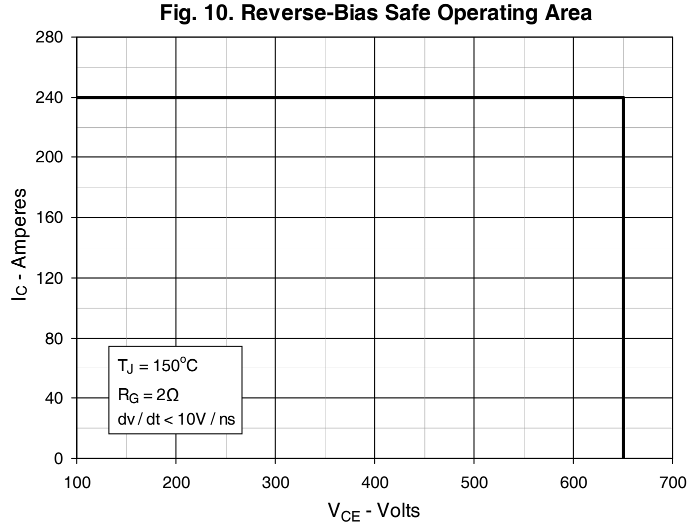



**Fig. 11. Forward-Bias Safe Operating Area**

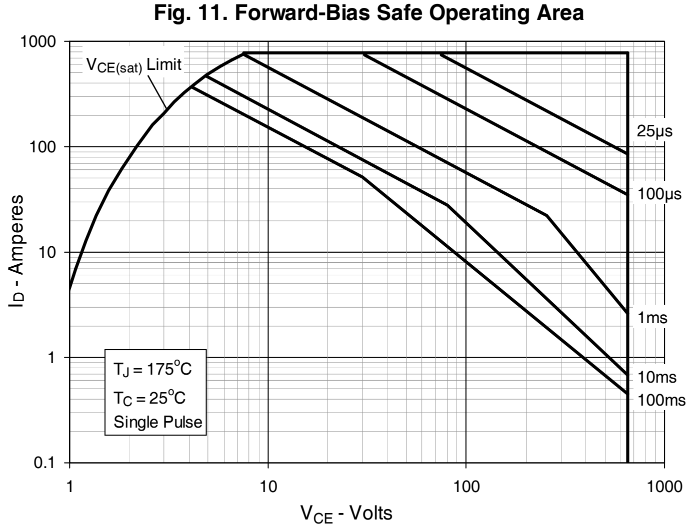



**Fig. 12. Maximum Trasient Thermal Impedance**

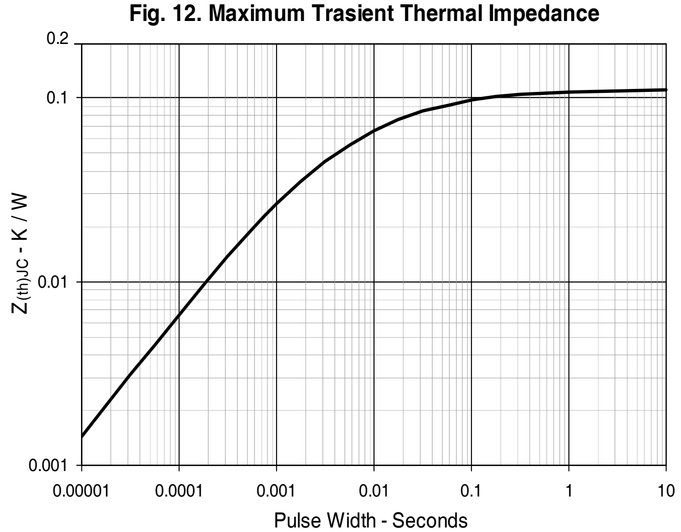


**Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance**

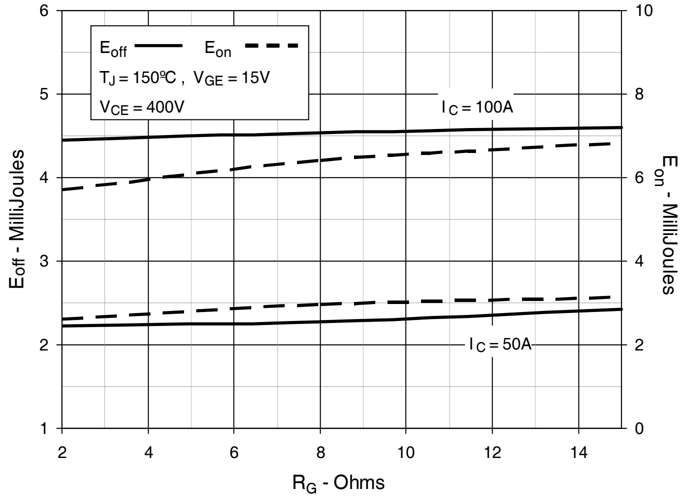



**Fig. 14. Inductive Switching Energy Loss vs. Collector Current**

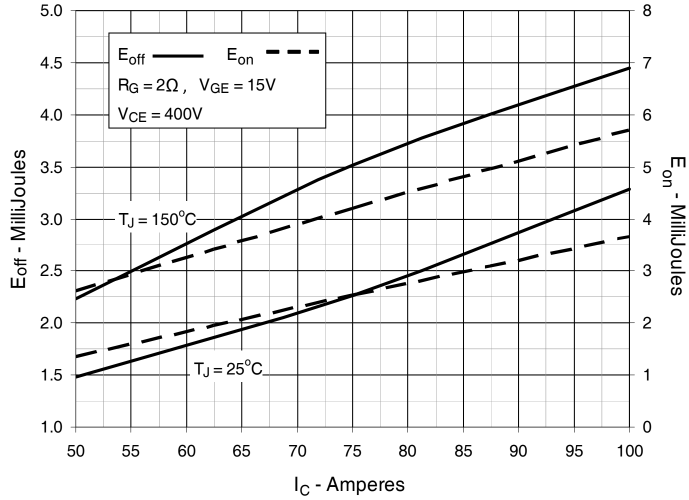



**Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature**

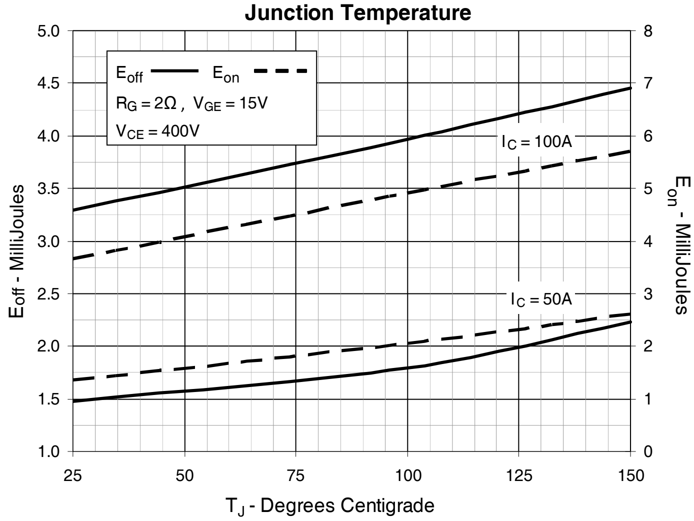



**Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance**

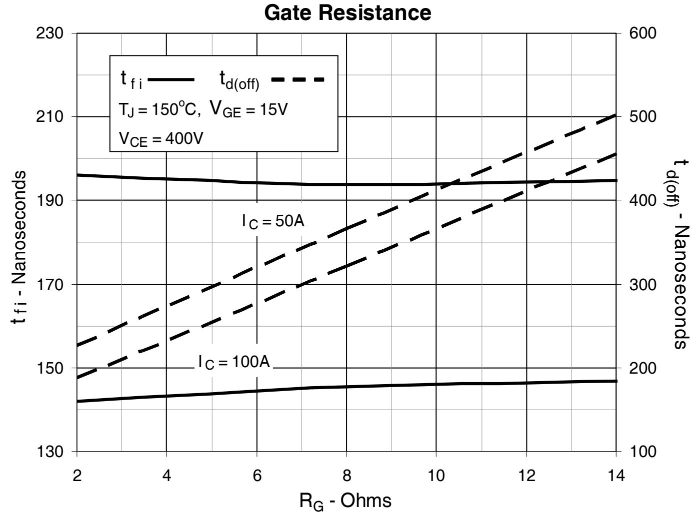



**Fig. 17. Inductive Turn-off Switching Times vs. Collector Current**

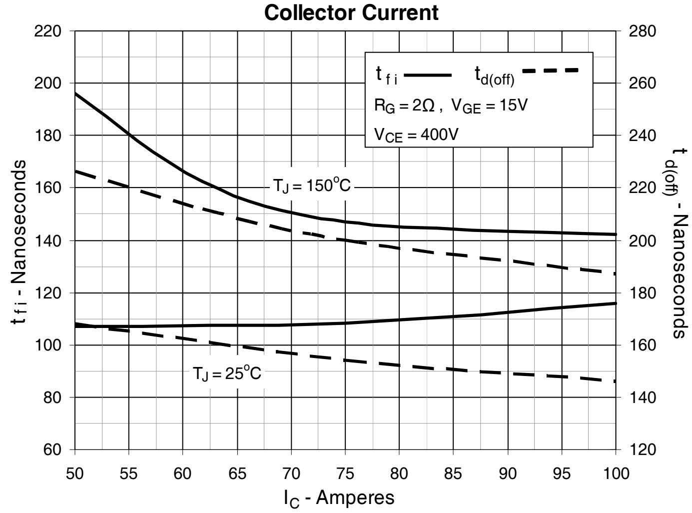



**Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature**

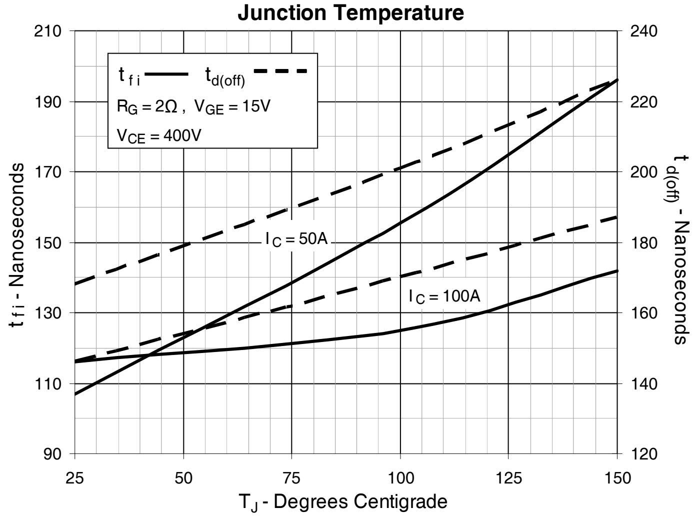


**Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance**

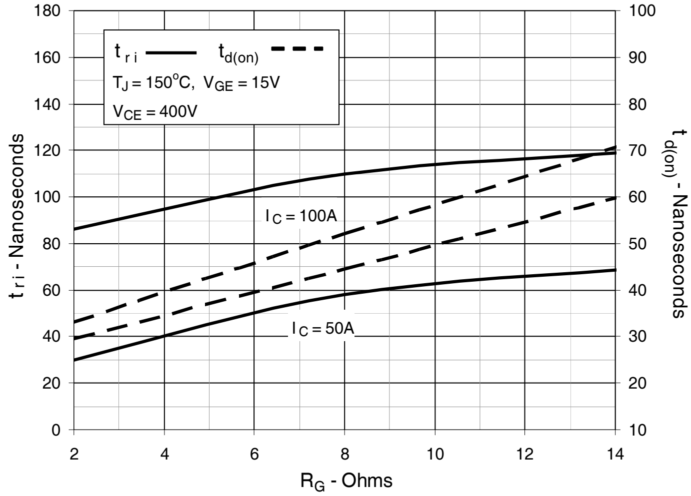



**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**

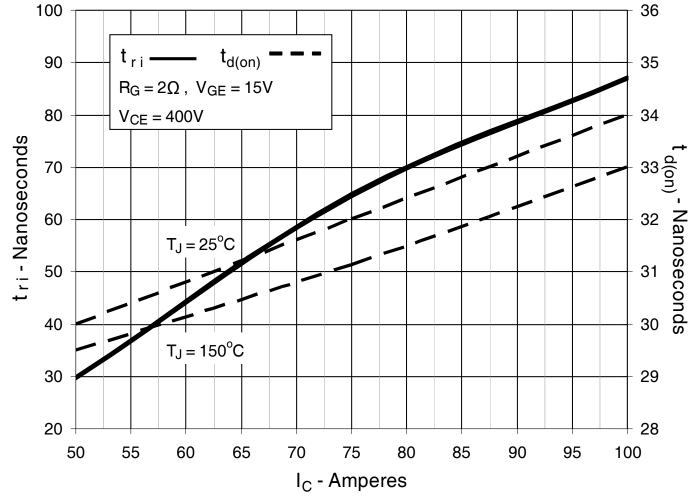
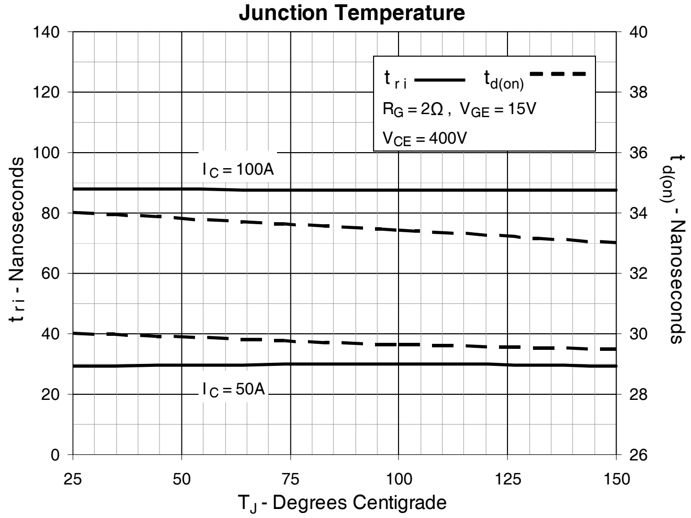
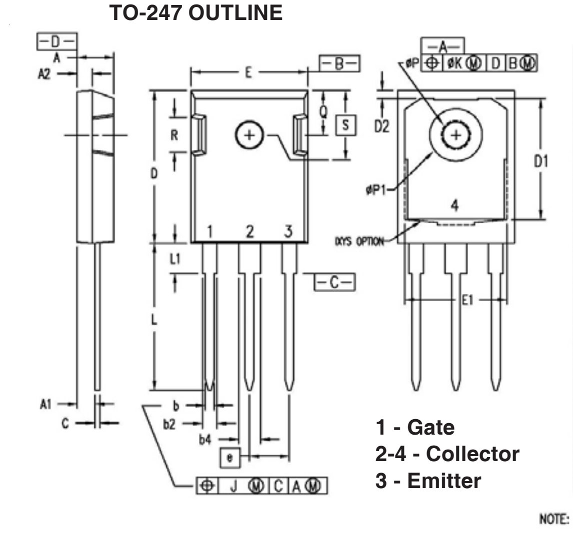



**Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature**




**TO-247 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 | |

NOTE: This drawing will meet all dimensions requirement of JEDEC outlines TO-247 AD (R-PSIP-F3)