# IXYS

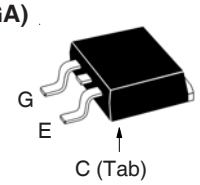
## GenX3™ 600V IGBTs

**IXGA48N60A3**
**IXGP48N60A3**
**IXGH48N60A3**

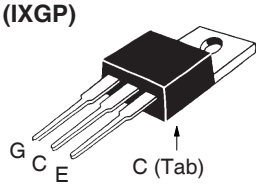
$V_{CES}$ = 600V
$I_{C110}$ = 48A
$V_{CE(sat)}$ ≤ 1.35V

Ultra Low Vsat PT IGBTs for up to 5kHz switching

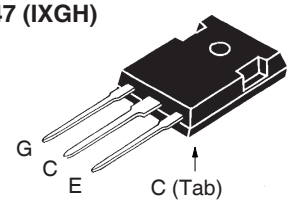
**TO-263 (IXGA)**




**TO-220 (IXGP)**




**TO-247 (IXGH)**




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 | 120 | A |
| $I_{C110}$ | $T_C$ = 110°C | 48 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1ms | 300 | A |
| SSOA (RBSOA) | $V_{GE}$ = 15V, $T_{VJ}$ = 125°C, $R_G$ = 5Ω<br>Clamped Inductive Load | $I_{CM}$ = 96<br>$V_{CE} \leq V_{CES}$ | A |
| $P_C$ | $T_C$ = 25°C | 300 | W |
| $T_J$ | | -55 ... +150 | °C |
| $T_{JM}$ | | 150 | °C |
| $T_{stg}$ | | -55 ... +150 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering | 300 | °C |
| $T_{SOLD}$ | 1.6 mm (0.062in.) from Case for 10s | 260 | °C |
| $F_C$ | Mounting Force (TO-263) | 10..65 / 2.2..14.6 | N/lb. |
| $M_d$ | Mounting Torque (TO-220 & TO-247) | 1.13 / 10 | Nm/lb.in. |
| Weight | TO-263 | 2.5 | g |
| | TO-220 | 3.0 | g |
| | TO-247 | 6.0 | g |

| Symbol | Test Conditions ($T_J$ = 25°C unless otherwise specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $BV_{CES}$ | $I_C$ = 250μA, $V_{GE}$ = 0V | 600 | | | V |
| $V_{GE(th)}$ | $I_C$ = 250μA, $V_{CE}$ = $V_{GE}$ | 3.0 | | 5.5 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0V | | | 25 | μA |
| | $T_J$ = 125°C | | | 250 | μA |
| $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ± 20V | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = 32A, $V_{GE}$ = 15V, Note 1 | | 1.18 | 1.35 | V |

### Features

- Optimized for Low Conduction Losses
- Square RBSOA
- High Current Handling Capability
- International Standard Packages

### Advantages

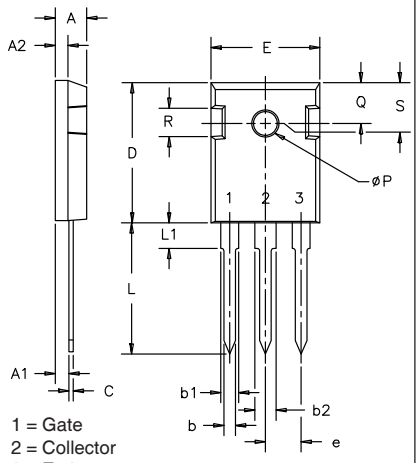
- High Power Density
- Low Gate Drive Requirement

### Applications

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

| 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 | 30 | 48 | | S |
| $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 3190 | | pF |
| $C_{oes}$ | | | 175 | | pF |
| $C_{res}$ | | | 43 | | pF |
| $Q_g$ | $I_C$ = 32A, $V_{GE}$ = 15V, $V_{CE}$ = 0.5 • $V_{CES}$ | | 110 | | nC |
| $Q_{ge}$ | | | 21 | | nC |
| $Q_{gc}$ | | | 42 | | nC |
| $t_{d(on)}$ | **Inductive Load, $T_J$ = 25°C** | | 25 | | ns |
| $t_{ri}$ | | | 30 | | ns |
| $E_{on}$ | $I_C$ = 32A, $V_{GE}$ = 15V | | 0.95 | | mJ |
| $t_{d(off)}$ | $V_{CE}$ = 480V, $R_G$ = 5Ω | | 334 | | ns |
| $t_{fi}$ | Note 2 | | 224 | | ns |
| $E_{off}$ | | | 2.9 | | mJ |
| $t_{d(on)}$ | **Inductive Load, $T_J$ = 125°C** | | 24 | | ns |
| $t_{ri}$ | | | 30 | | ns |
| $E_{on}$ | $I_C$ = 32A, $V_{GE}$ = 15V | | 1.97 | | mJ |
| $t_{d(off)}$ | $V_{CE}$ = 480V, $R_G$ = 5Ω | | 545 | | ns |
| $t_{fi}$ | Note 2 | | 380 | | ns |
| $E_{off}$ | | | 5.6 | | mJ |
| $R_{thJC}$ | | | | 0.42 | °C/W |
| $R_{thCK}$ | TO-220 | | 0.50 | | °C/W |
| | TO-247 | | 0.21 | | °C/W |

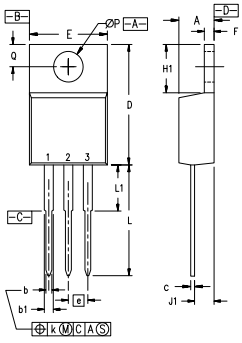
**TO-247 Outline**




1 = Gate
2 = Collector
3 = Emitter

| SYM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | .185 | .209 | 4.7 | 5.3 |
| $A_1$ | .087 | .102 | 2.2 | 2.54 |
| $A_2$ | .059 | .098 | 2.2 | 2.6 |
| b | .040 | .055 | 1.0 | 1.4 |
| $b_1$ | .065 | .084 | 1.65 | 2.13 |
| $b_2$ | .113 | .123 | 2.87 | 3.12 |
| C | .016 | .031 | .4 | .8 |
| D | .819 | .845 | 20.80 | 21.46 |
| E | .610 | .640 | 15.75 | 16.26 |
| e | .215 BSC | | 5.45 BSC | |
| L | .780 | .800 | 19.81 | 20.32 |
| L1 | | .177 | | 4.50 |
| øP | .140 | .144 | 3.55 | 3.65 |
| Q | .212 | .244 | 5.4 | 6.2 |
| R | .170 | .216 | 4.32 | 5.49 |
| S | .242 BSC | | 6.15 BSC | |

**TO-220 Outline**



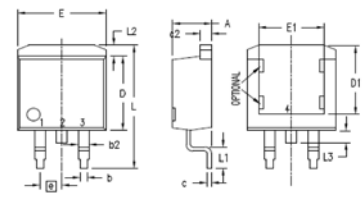

Pins: 1 - Gate 2 - Collector
3 - Emitter

| SYM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | .170 | .190 | 4.32 | 4.83 |
| b | .025 | .040 | 0.64 | 1.02 |
| b1 | .045 | .065 | 1.15 | 1.65 |
| c | .014 | .022 | 0.35 | 0.56 |
| D | .580 | .630 | 14.73 | 16.00 |
| E | .390 | .420 | 9.91 | 10.66 |
| e | .100 BSC | | 2.54 BSC | |
| F | .045 | .055 | 1.14 | 1.40 |
| H1 | .230 | .270 | 5.85 | 6.85 |
| J1 | .090 | .110 | 2.29 | 2.79 |
| k | 0 | .015 | 0 | 0.38 |
| L | .500 | .550 | 12.70 | 13.97 |
| L1 | .110 | .230 | 2.79 | 5.84 |
| ØP | .139 | .161 | 3.53 | 4.08 |
| Q | .100 | .125 | 2.54 | 3.18 |

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-263 Outline**




1 = Gate
2 = Collector
3 = Emitter
4 = Collector

| SYM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | .160 | .190 | 4.06 | 4.83 |
| A1 | .080 | .110 | 2.03 | 2.79 |
| b | .020 | .039 | 0.51 | 0.99 |
| b2 | .045 | .055 | 1.14 | 1.40 |
| c | .016 | .029 | 0.40 | 0.74 |
| c2 | .045 | .055 | 1.14 | 1.40 |
| D | .340 | .380 | 8.64 | 9.65 |
| D1 | .315 | .350 | 8.00 | 8.89 |
| E | .380 | .410 | 9.65 | 10.41 |
| E1 | .245 | .320 | 6.22 | 8.13 |
| e | .100 BSC | | 2.54 BSC | |
| L | .575 | .625 | 14.61 | 15.88 |
| L1 | .090 | .110 | 2.29 | 2.79 |
| L2 | .040 | .055 | 1.02 | 1.40 |
| L3 | .050 | .070 | 1.27 | 1.78 |
| L4 | 0 | .005 | 0 | 0.13 |

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

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

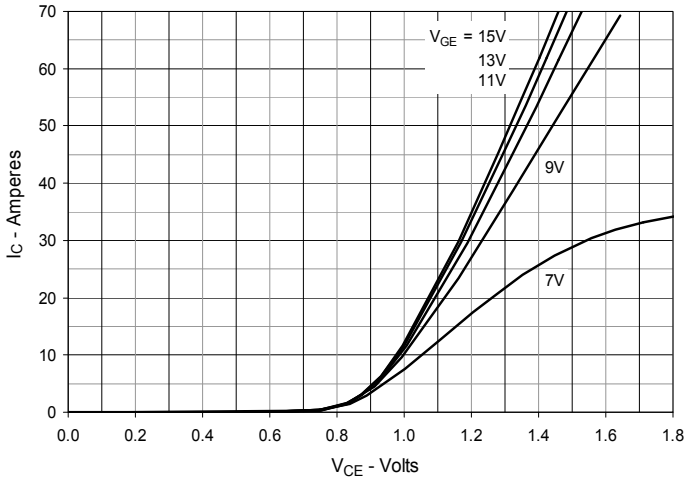



**Fig. 2. Extended Output Characteristics @ $T_J$ = 25ºC**

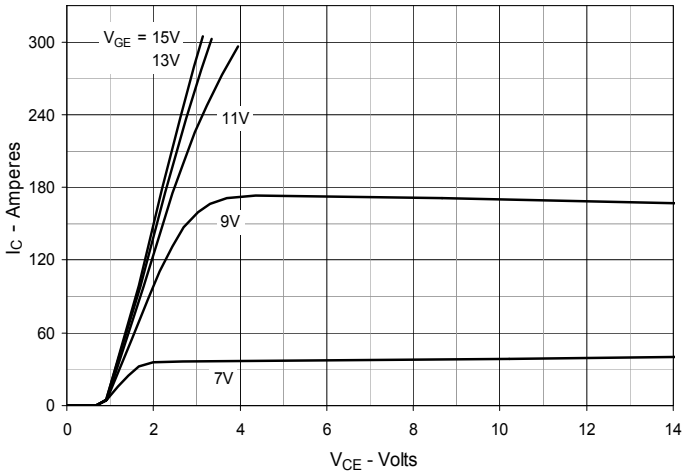



**Fig. 3. Output Characteristics @ $T_J$ = 125ºC**

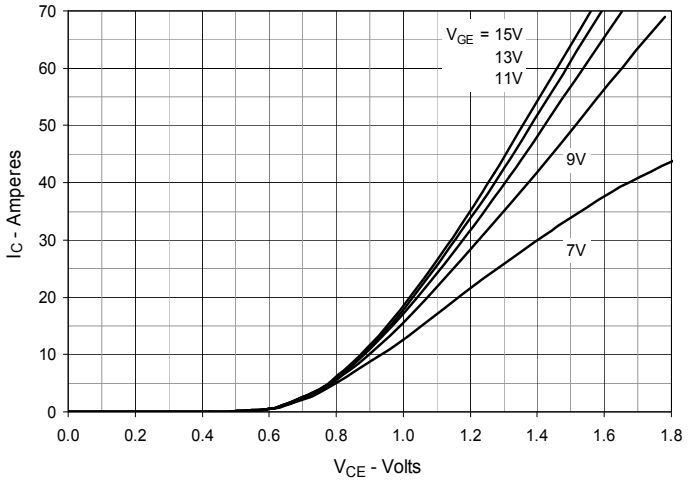



**Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature**

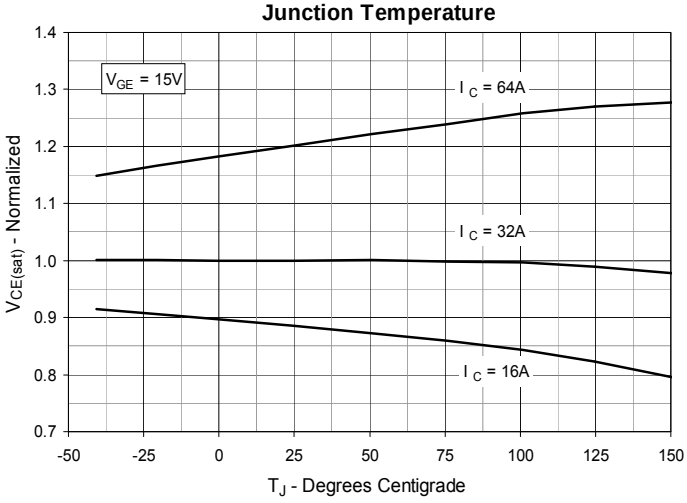



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

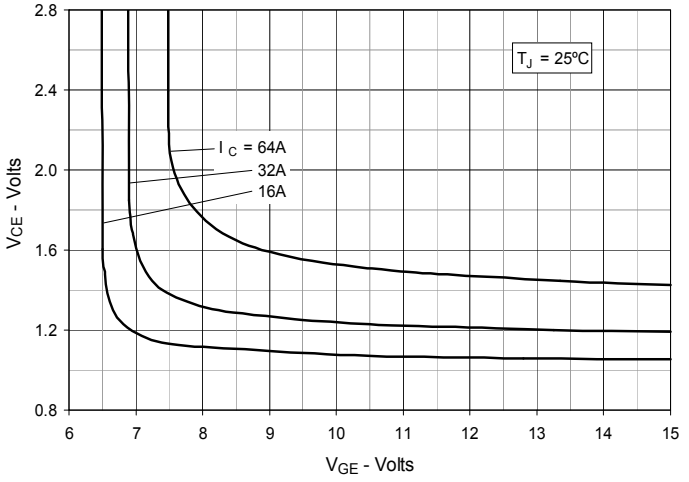



**Fig. 6. Input Admittance**

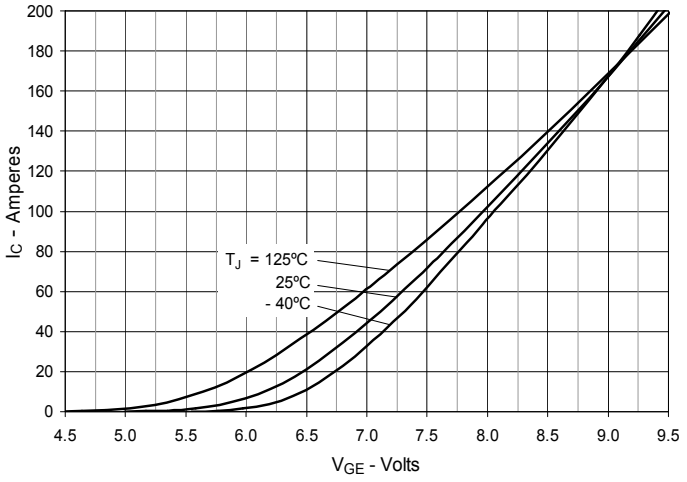


**Fig. 7. Transconductance**

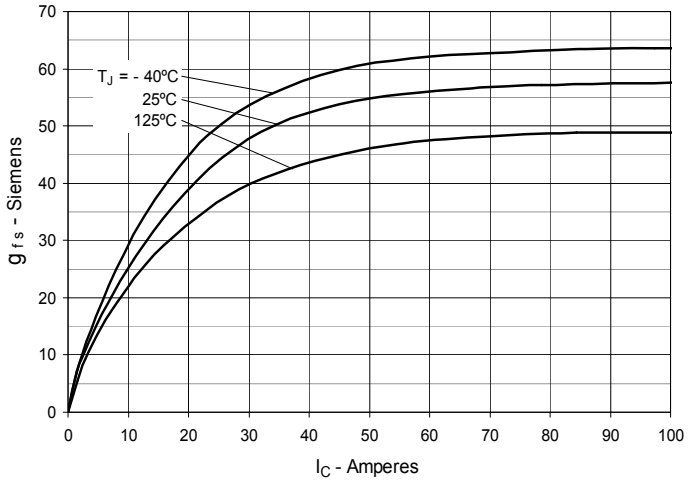



**Fig. 8. Gate Charge**

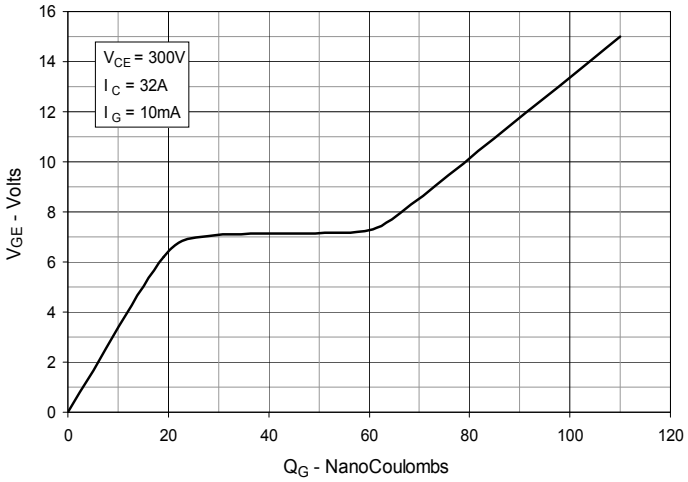



**Fig. 9. Capacitance**

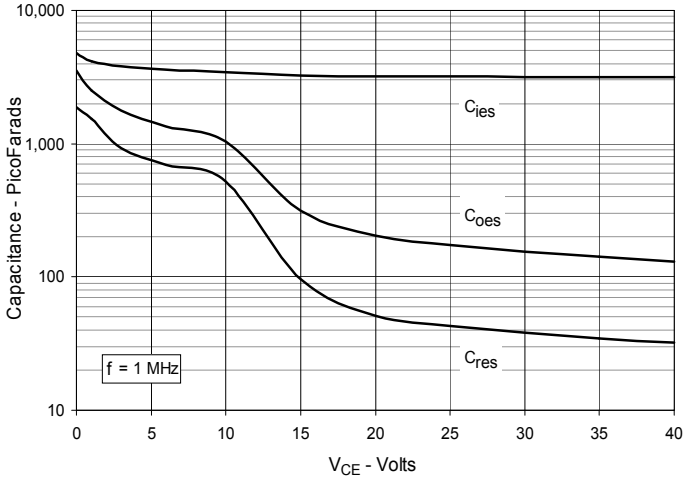



**Fig. 10. Reverse-Bias Safe Operating Area**

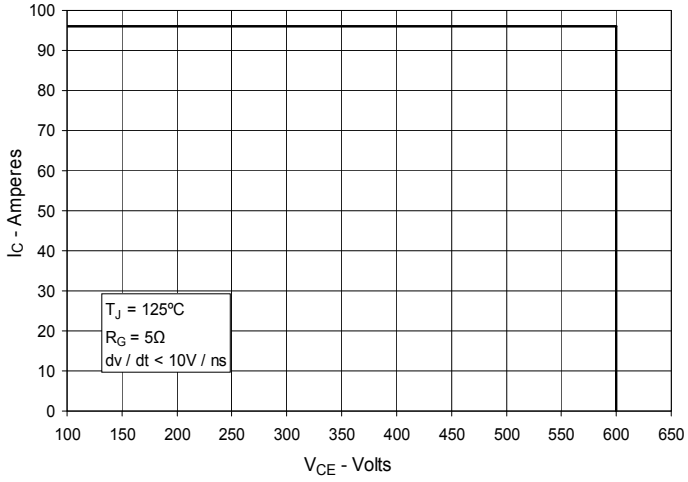



**Fig. 11. Maximum Transient Thermal Impedance**

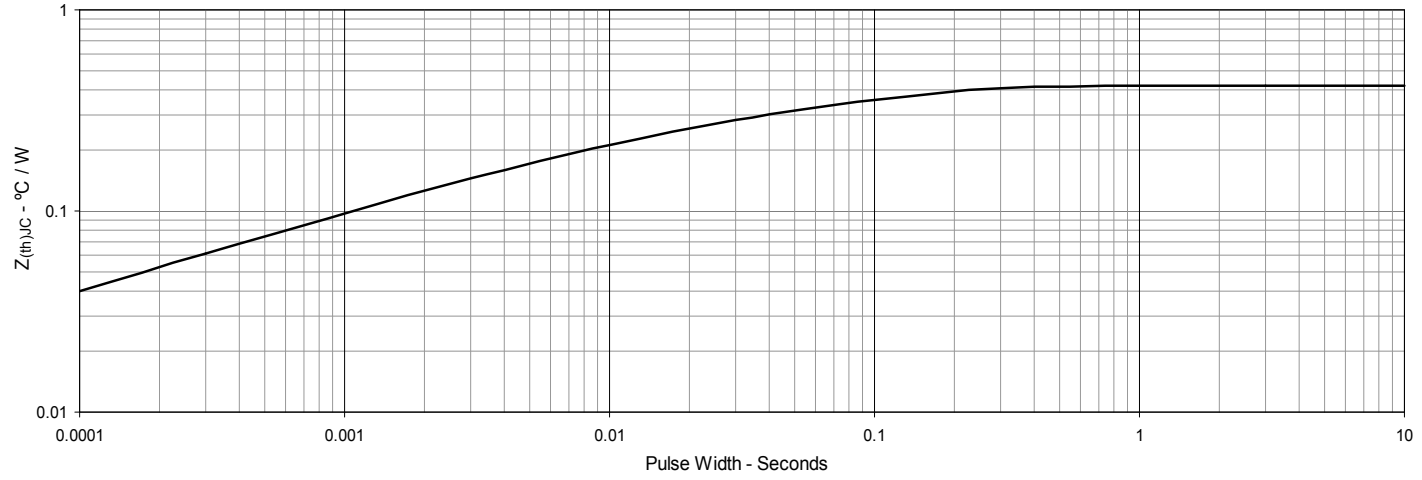


**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**

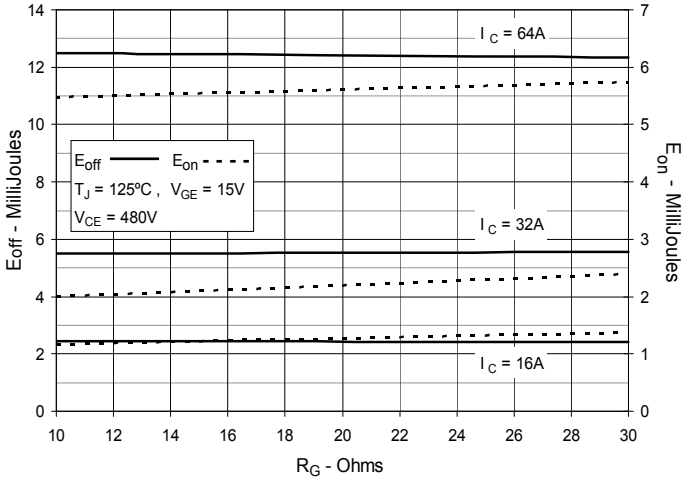



**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**

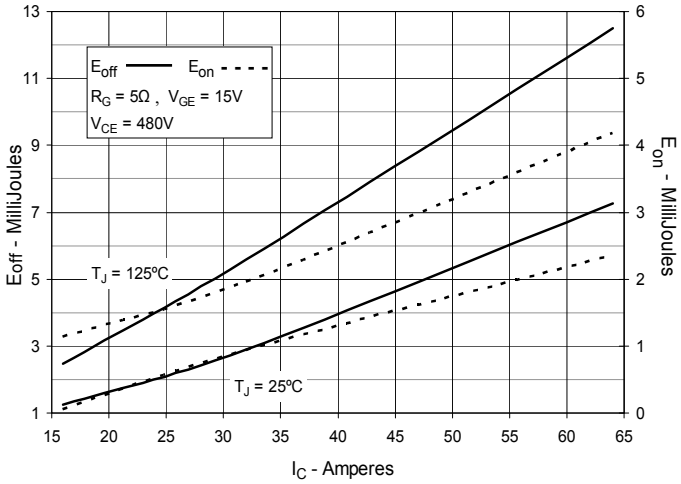



**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**

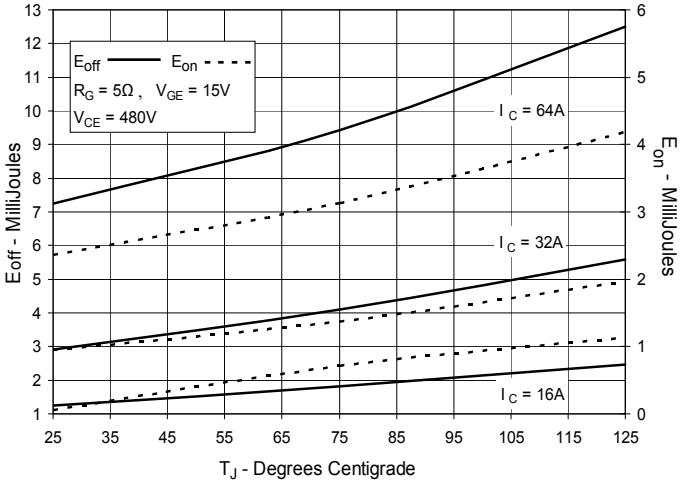



**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**

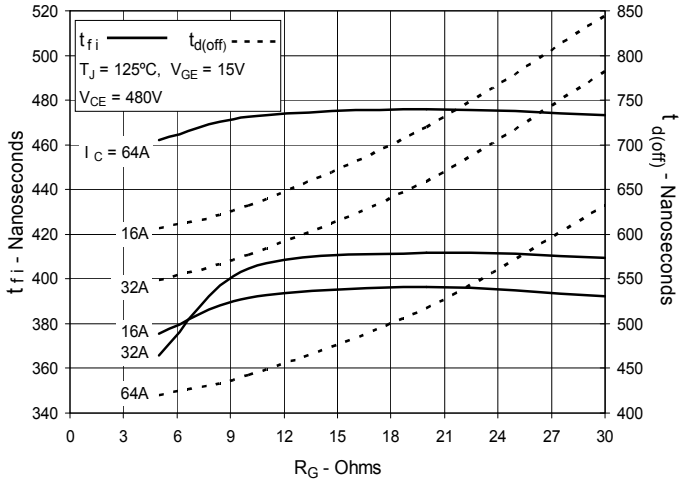



**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**

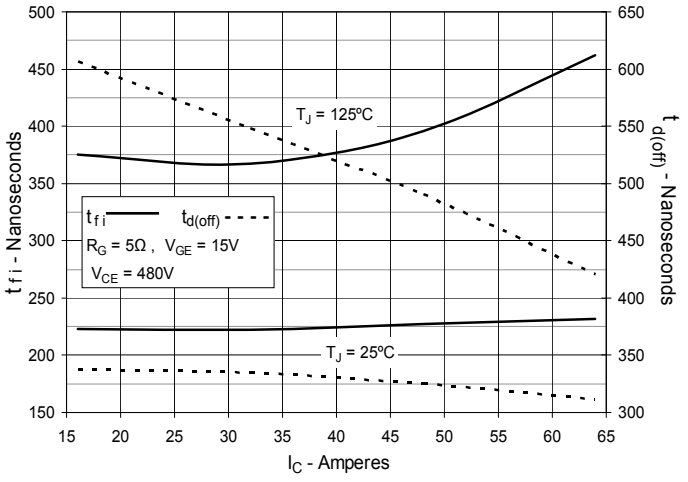



**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**

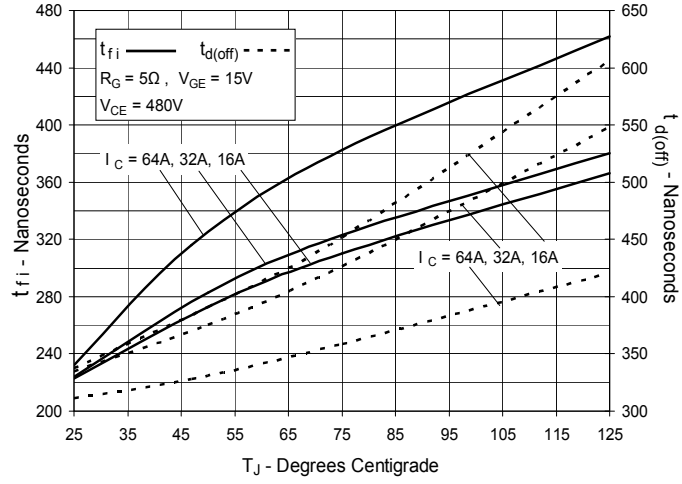


**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**

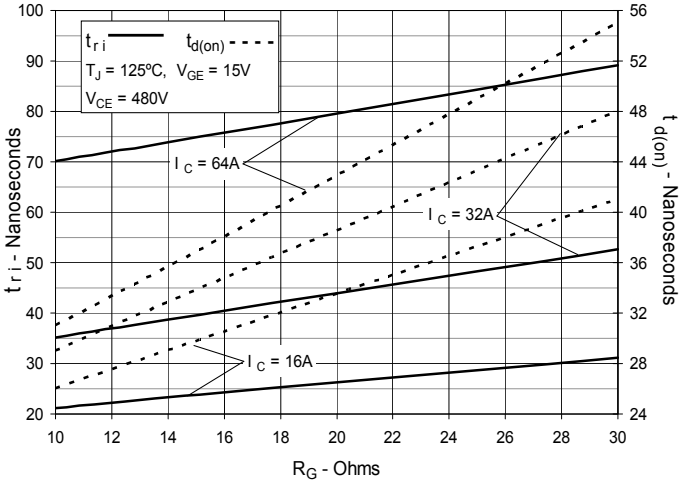



**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**

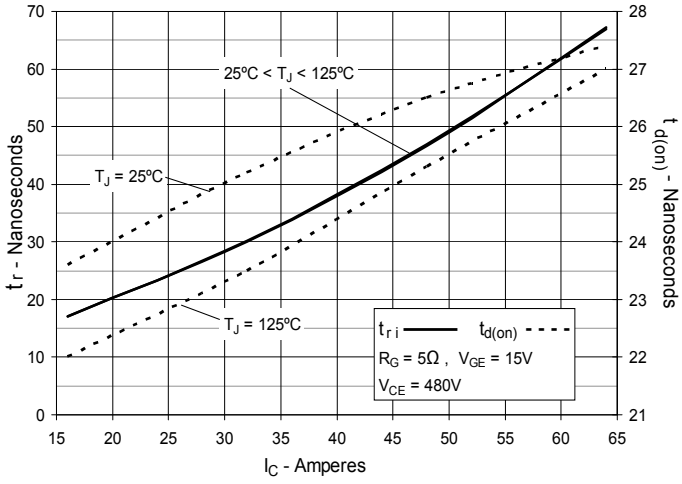



**Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature**