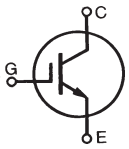
IXYS

# GenX3™ 600V IGBT

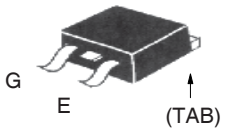
## IXGA48N60A3
## IXGH48N60A3
## IXGP48N60A3

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

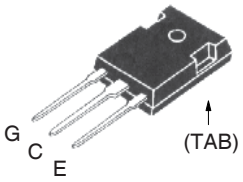
Ultra Low Vsat PT IGBT for up to 5kHz switching



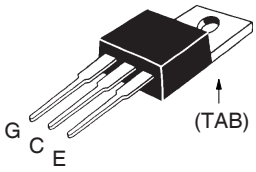

**TO-263 (IXGA)**




**TO-247 (IXGH)**




**TO-220 (IXGP)**




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

| Symbol | Test Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_C$ = 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 |
| $I_{C110}$ | $T_C$ = 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 @ ≤ 600V | $I_{CM}$ = 96 | A |
| $P_C$ | $T_C$ = 25°C | 300 | W |
| $T_J$ | | -55 ... +150 | °C |
| $T_{JM}$ | | 150 | °C |
| $T_{stg}$ | | -55 ... +150 | °C |
| $T_L$ | 1.6mm (0.062 in.) from case for 10s | 300 | °C |
| $T_{SOLD}$ | Plastic body for 10 seconds | 260 | °C |
| $M_d$ | Mounting torque (TO-247 & TO-220) | 1.13/10 | Nm/lb.in. |
| Weight | TO-247 | 6.0 | g |
| | TO-220 | 3.0 | g |
| | TO-263 | 2.5 | 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 | | 5.0 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$ | | | | 25 | μA |
| | $V_{GE}$ = 0V | $T_J$ = 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
- 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

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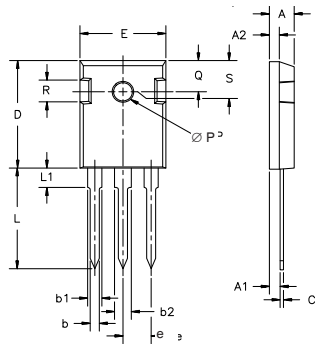
| Symbol | Test Conditions ($T_J$ = 25°C unless otherwise specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $g_{fs}$ | $I_C$ = 32A, $V_{CE}$ = 10V, Note 1 | 30 | 48 | | S |
| $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 3190 | | pF |
| $C_{oes}$ | | | 175 | | 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 |
| $t_{ri}$ | $I_C$ = 32A, $V_{GE}$ = 15V | | 30 | | ns |
| $E_{on}$ | $V_{CE}$ = 480V, $R_G$ = 5Ω | | 0.95 | | mJ |
| $t_{d(off)}$ | | | 334 | | ns |
| $t_{fi}$ | | | 224 | | ns |
| $E_{off}$ | | | 2.90 | | mJ |
| $t_{d(on)}$ | **Inductive Load, $T_J$ = 25°C** | | 24 | | ns |
| $t_{ri}$ | $I_C$ = 32A, $V_{GE}$ = 15V | | 30 | | ns |
| $E_{on}$ | $V_{CE}$ = 480V, $R_G$ = 5Ω | | 1.97 | | mJ |
| $t_{d(off)}$ | | | 545 | | ns |
| $t_{fi}$ | | | 380 | | ns |
| $E_{off}$ | | | 5.60 | | mJ |
| $R_{thJC}$ | | | | 0.42 | °C/W |
| $R_{thCS}$ | (TO-247) | | 0.25 | | °C/W |
| | (TO-220) | | 0.50 | | °C/W |

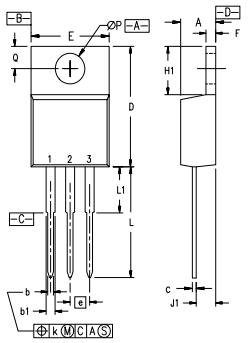
Note 1: Pulse test, t ≤ 300µs; duty cycle, d ≤ 2%.

## TO-247 (IXGH) 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 |
| ØP | 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 |

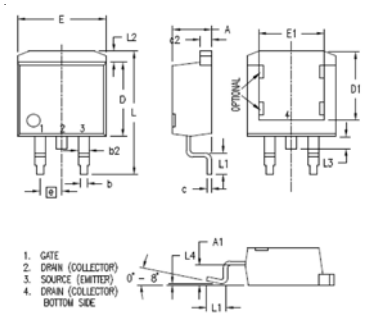
## TO-220 (IXGP) Outline




Pins: 1 - Gate 2 - Drain
3 - Source 4 - Drain

| SYM | INCHES MIN | MAX | MILLIMETERS MIN | 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 |

## TO-263 (IXGA) Outline




| SYM | INCHES MIN | MAX | MILLIMETERS MIN | 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 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 4,931,844 5,049,961 5,237,481 6,162,665 6,404,065 B1 6,683,344 6,727,585 7,005,734 B2 7,157,338B2 4,850,072 5,017,508 5,063,307 5,381,025 6,259,123 B1 6,534,343 6,710,405 B2 6,759,692 7,063,975 B2 4,881,106 5,034,796 5,187,117 5,486,715 6,306,728 B1 6,583,505 6,710,463 6,771,478 B2 7,071,537

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

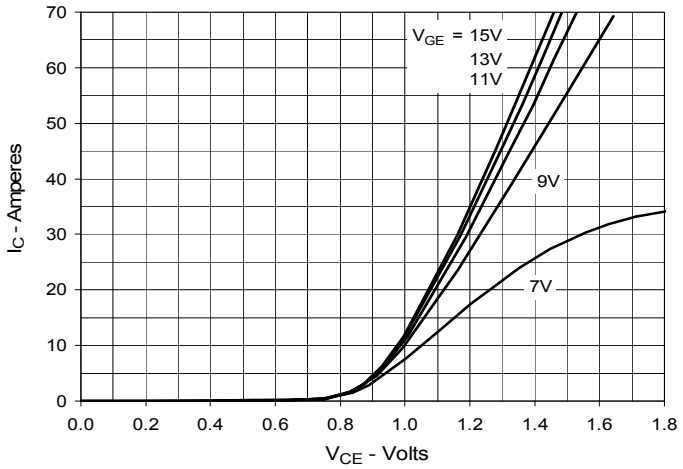



**Fig. 2. Extended Output Characteristics @ 25ºC**

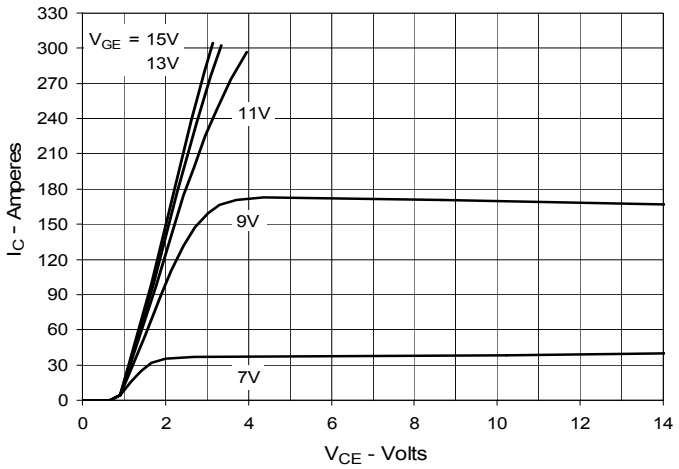



**Fig. 3. Output Characteristics @ 125ºC**

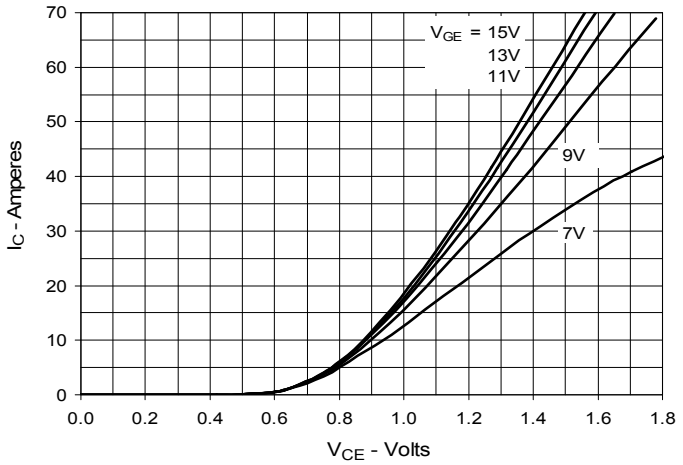



**Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature**

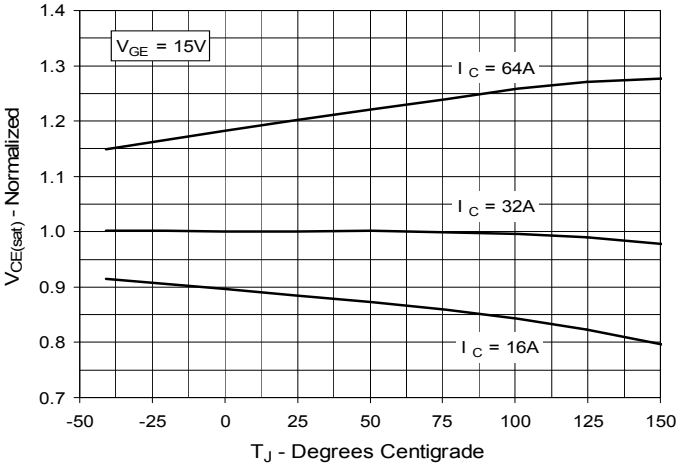



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

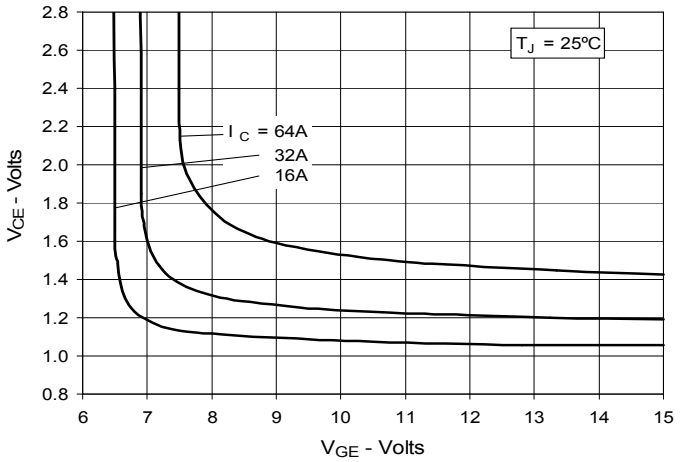



**Fig. 6. Input Admittance**

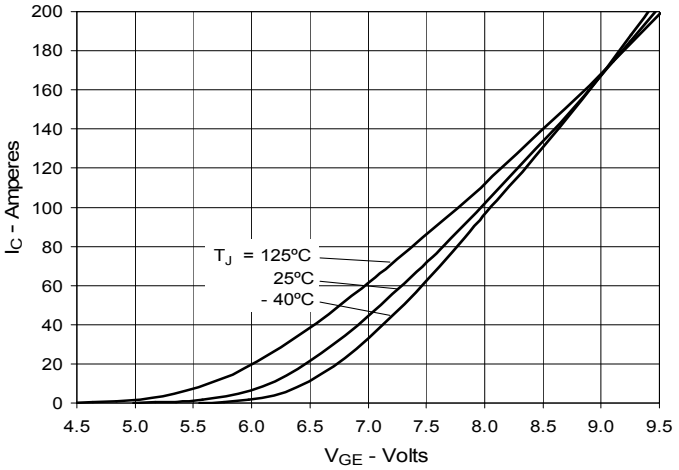



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**Fig. 7. Transconductance**

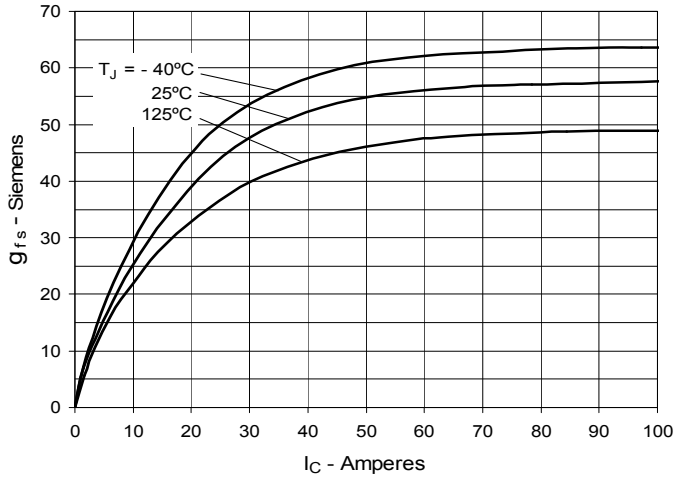


**Fig. 8. Gate Charge**

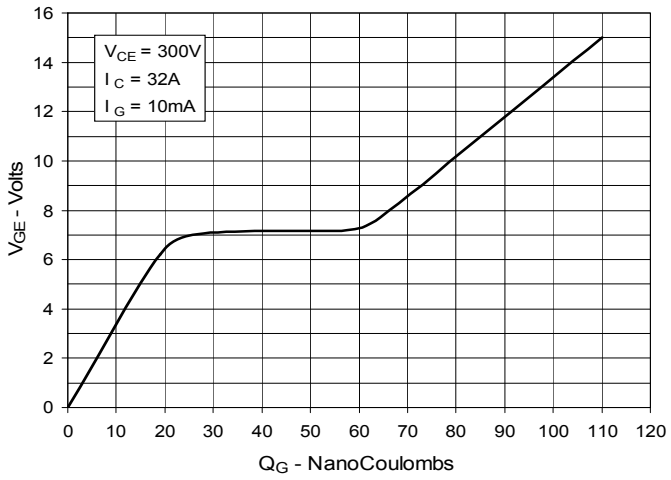


**Fig. 9. Capacitance**

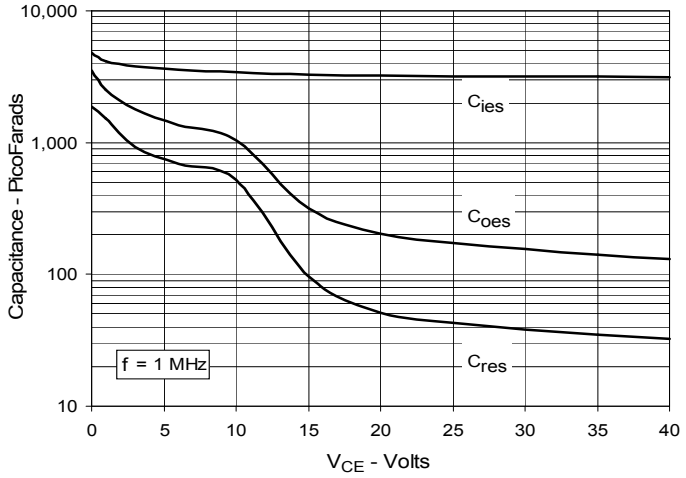


**Fig. 10. Reverse-Bias Safe Operating Area**

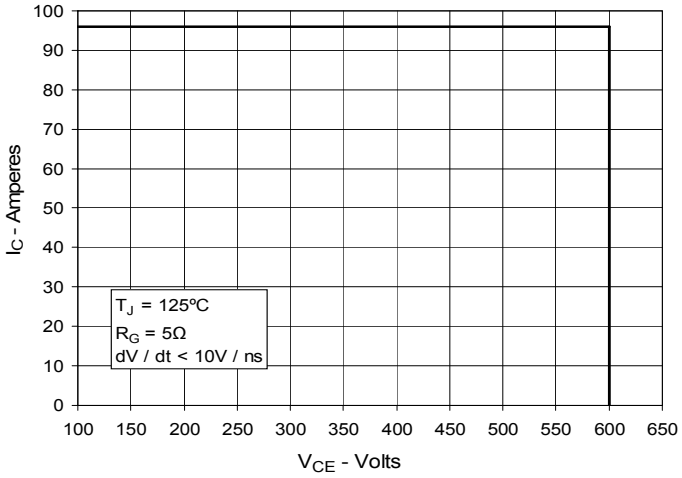


**Fig. 11. Maximum Transient Thermal Impedance**

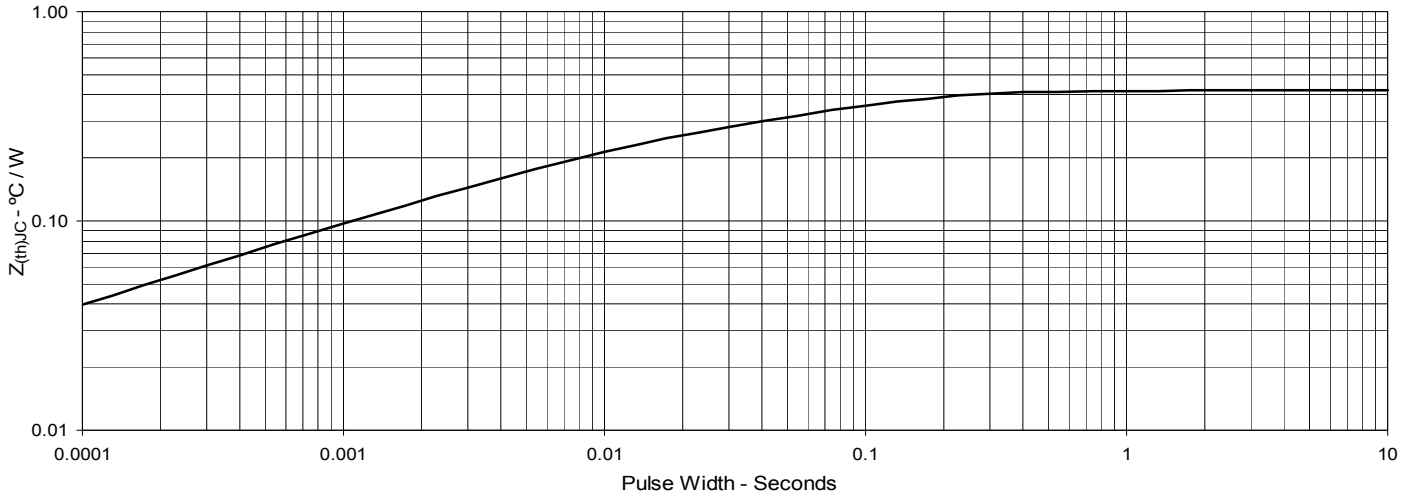


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**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**

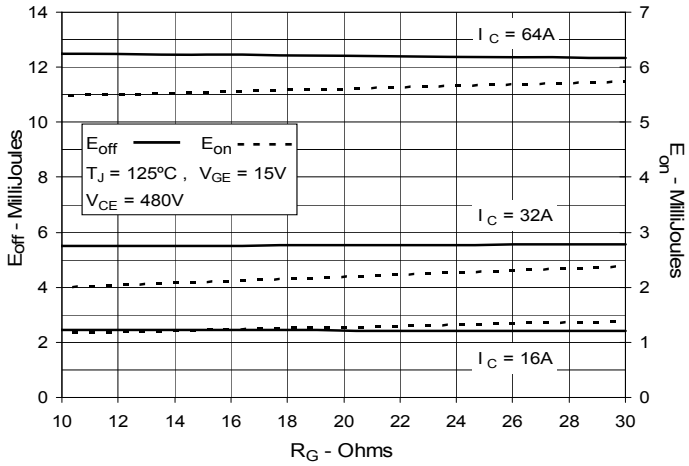


**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**

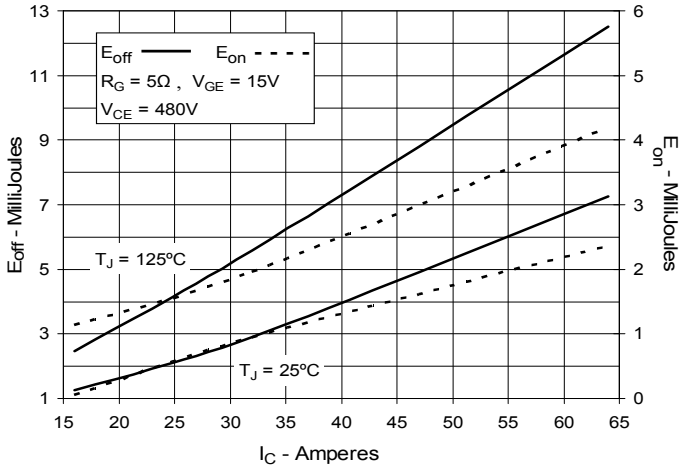


**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**

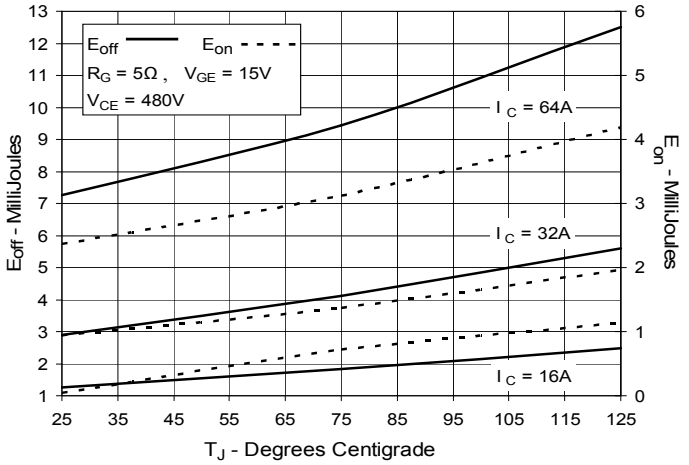


**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**

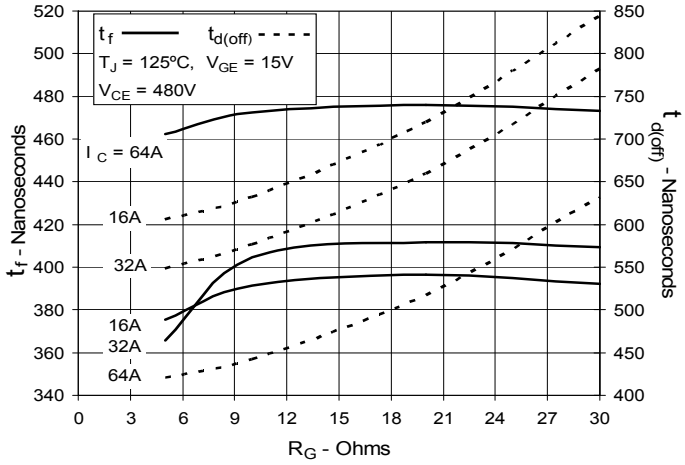


**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**

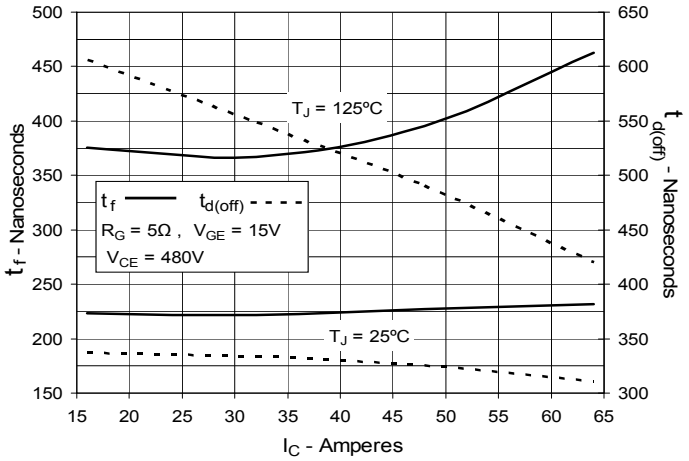


**Fig. 17. Inductive Turn-on Switching Times vs. Junction Temperature**

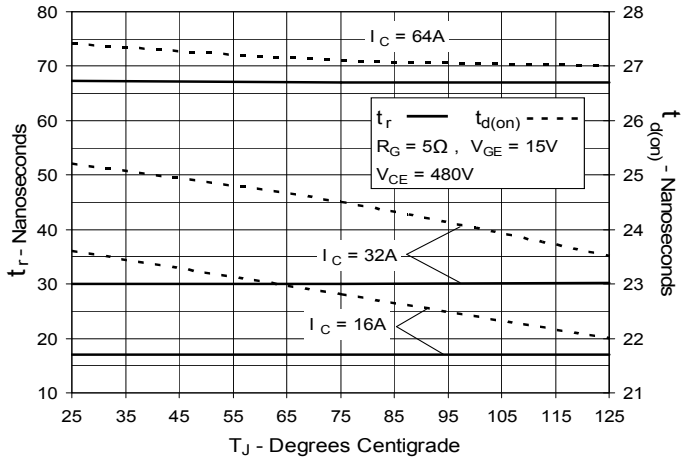


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**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**

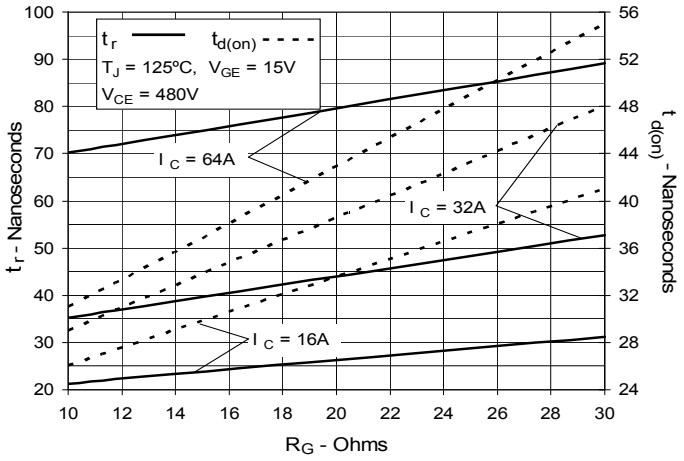



**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**

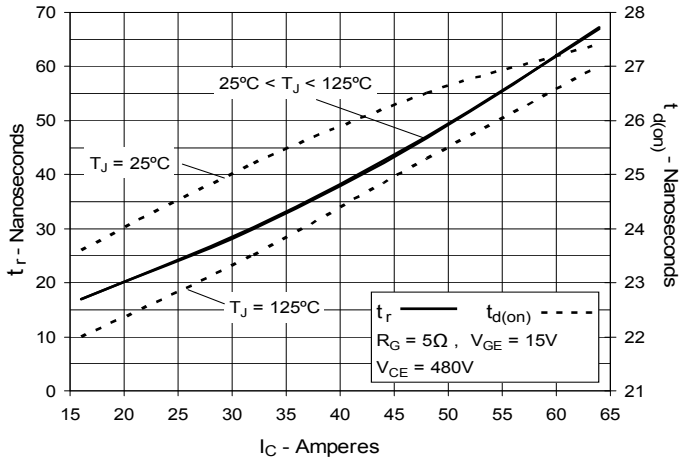
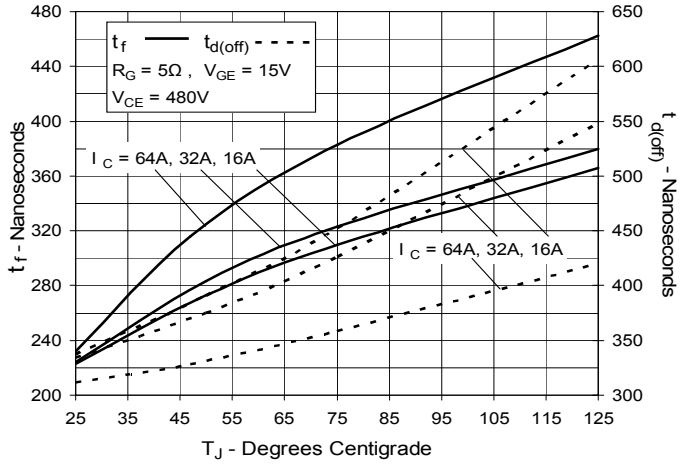



**Fig. 20. Inductive Turn-off Switching Times vs. Junction Temperature**

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