IXYS

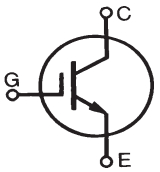
Preliminary Technical Information

# GenX3™ 600V IGBTs

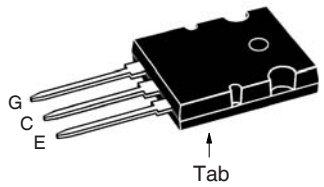
# IXGK320N60B3
# IXGX320N60B3

$V_{CES}$ = 600V
$I_{C90}$ = 320A
$V_{CE(sat)} \leq$ 1.6V

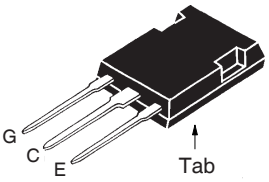
Medium-Speed Low-Vsat PT IGBTs for 5-40 kHz Switching




**TO-264 (IXGK)**




**PLUS247 (IXGX)**




G = Gate E = Emitter
C = Collector 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 ( Chip Capability ) | 500 | A |
| $I_{C90}$ | $T_C$ = 90°C | 320 | A |
| $I_{LRMS}$ | Terminal Current Limit | 160 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1ms | 1200 | A |
| **SSOA (RBSOA)** | $V_{GE}$= 15V, $T_{VJ}$ = 125°C, $R_G$ = 1Ω<br>Clamped Inductive Load | $I_{CM}$ = 320<br>$V_{CE} \leq V_{CES}$ | A<br>V |
| $P_C$ | $T_C$ = 25°C | 1700 | 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 (0.062 in.) from Case for 10 | 260 | °C |
| $M_d$ | Mounting Torque ( IXGK ) | 1.13/10 | Nm/lb.in. |
| $F_C$ | Mounting Force ( IXGX ) | 20..120/4.5..27 | N/lb. |
| **Weight** | TO-264 | 10 | g |
| | PLUS247 | 6 | g |

| Symbol | Test Conditions ($T_J$ = 25°C, Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $BV_{CES}$ | $I_C$ = 1mA, $V_{GE}$ = 0V | 600 | | | V |
| $V_{GE(th)}$ | $I_C$ = 4mA, $V_{CE}$ = $V_{GE}$ | 3.0 | | 5.0 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0V | | | 75 | μA |
| | $T_J$ = 125°C | | | 2 | mA |
| $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ± 20V | | | ±400 | nA |
| $V_{CE(sat)}$ | $I_C$ = 100A, $V_{GE}$ = 15V, Note 1 | | 1.4 | 1.6 | V |
| | $I_C$ = 320A | | 2.0 | | V |

## Features

- Optimized for Low Conduction and Switching Losses
- High Current Capability
- Square RBSOA

## 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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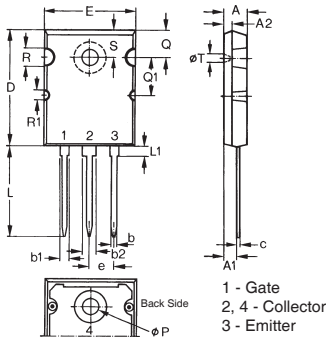
| Symbol | Test Conditions ($T_J$ = 25°C, Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $g_{fs}$ | $I_C$ = 60A, $V_{CE}$ = 10V, Note 1 | 70 | 125 | | S |
| $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 18 | | nF |
| $C_{oes}$ | | | 960 | | pF |
| $C_{res}$ | | | 130 | | pF |
| $Q_g$ | $I_C$ = 320A, $V_{GE}$ = 15V, $V_{CE}$ = 0.5 • $V_{CES}$ | | 585 | | nC |
| $Q_{ge}$ | | | 105 | | nC |
| $Q_{gc}$ | | | 215 | | nC |
| $t_{d(on)}$ | **Inductive Load, $T_J$ = 25°C** $I_C$ = 100A, $V_{GE}$ = 15V $V_{CE}$ = 0.8 • $V_{CES}$, $R_G$ = 1Ω | | 44 | | ns |
| $t_{ri}$ | | | 66 | | ns |
| $E_{on}$ | | | 2.7 | | mJ |
| $t_{d(off)}$ | | | 250 | | ns |
| $t_{fi}$ | | | 165 | | ns |
| $E_{off}$ | | | 3.5 | 5.0 | mJ |
| $t_{d(on)}$ | **Inductive Load, $T_J$ = 125°C** $I_C$ = 100A, $V_{GE}$ = 15V $V_{CE}$ = 0.8 • $V_{CES}$, $R_G$ = 1Ω | | 40 | | ns |
| $t_{ri}$ | | | 67 | | ns |
| $E_{on}$ | | | 3.5 | | mJ |
| $t_{d(off)}$ | | | 330 | | ns |
| $t_{fi}$ | | | 265 | | ns |
| $E_{off}$ | | | 5.4 | | mJ |
| $R_{thJC}$ | | | | 0.073 | °C/W |
| $R_{thCS}$ | | | 0.15 | | °C/W |

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

**PRELIMINARY TECHNICAL INFORMATION**

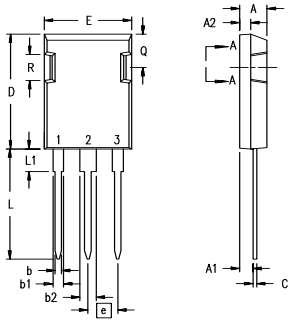
The product presented herein is under development. The Technical Specifications offered are derived from data gathered during objective characterizations of preliminary engineering lots; but also may yet contain some information supplied during a pre-production design evaluation. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

**TO-264 AA ( IXGK) Outline**




| Dim. | Millimeter Min. | Max. | Inches Min. | Max. |
|---|---|---|---|---|
| A | 4.82 | 5.13 | .190 | .202 |
| A1 | 2.54 | 2.89 | .100 | .114 |
| A2 | 2.00 | 2.10 | .079 | .083 |
| b | 1.12 | 1.42 | .044 | .056 |
| b1 | 2.39 | 2.69 | .094 | .106 |
| b2 | 2.90 | 3.09 | .114 | .122 |
| c | 0.53 | 0.83 | .021 | .033 |
| D | 25.91 | 26.16 | 1.020 | 1.030 |
| E | 19.81 | 19.96 | .780 | .786 |
| e | 5.46 BSC | | .215 BSC | |
| J | 0.00 | 0.25 | .000 | .010 |
| K | 0.00 | 0.25 | .000 | .010 |
| L | 20.32 | 20.83 | .800 | .820 |
| L1 | 2.29 | 2.59 | .090 | .102 |
| P | 3.17 | 3.66 | .125 | .144 |
| Q | 6.07 | 6.27 | .239 | .247 |
| Q1 | 8.38 | 8.69 | .330 | .342 |
| R | 3.81 | 4.32 | .150 | .170 |
| R1 | 1.78 | 2.29 | .070 | .090 |
| S | 6.04 | 6.30 | .238 | .248 |
| T | 1.57 | 1.83 | .062 | .072 |

**PLUS247™ (IXGX) Outline**




Terminals: 1 - Gate
2 - Collector
3 - Emitter

| Dim. | Millimeter Min. | Max. | Inches Min. | Max. |
|---|---|---|---|---|
| A | 4.83 | 5.21 | .190 | .205 |
| $A_1$ | 2.29 | 2.54 | .090 | .100 |
| $A_2$ | 1.91 | 2.16 | .075 | .085 |
| b | 1.14 | 1.40 | .045 | .055 |
| $b_1$ | 1.91 | 2.13 | .075 | .084 |
| $b_2$ | 2.92 | 3.12 | .115 | .123 |
| C | 0.61 | 0.80 | .024 | .031 |
| D | 20.80 | 21.34 | .819 | .840 |
| E | 15.75 | 16.13 | .620 | .635 |
| e | 5.45 BSC | | .215 BSC | |
| L | 19.81 | 20.32 | .780 | .800 |
| L1 | 3.81 | 4.32 | .150 | .170 |
| Q | 5.59 | 6.20 | .220 | 0.244 |
| R | 4.32 | 4.83 | .170 | .190 |

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 4,850,072 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 @ $T_J$ = 25ºC**

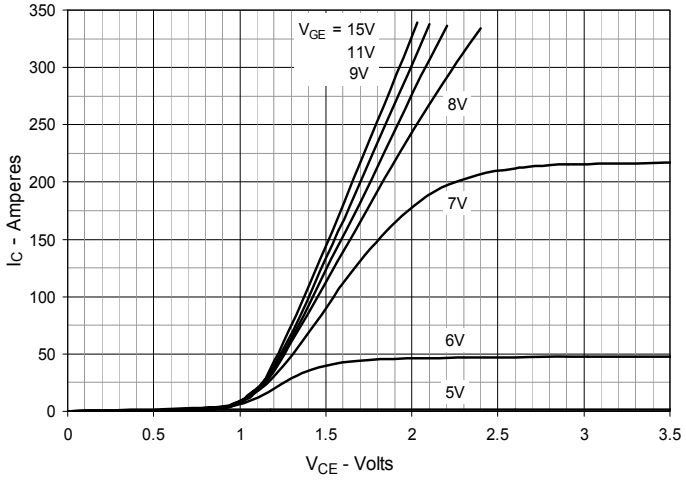



**Fig. 2. Output Characteristics @ $T_J$ = 125ºC**

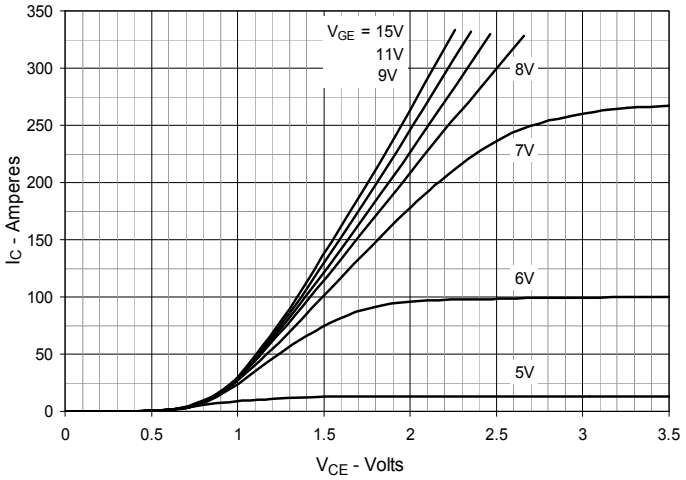



**Fig. 3. Dependence of $V_{CE(sat)}$ on Junction Temperature**

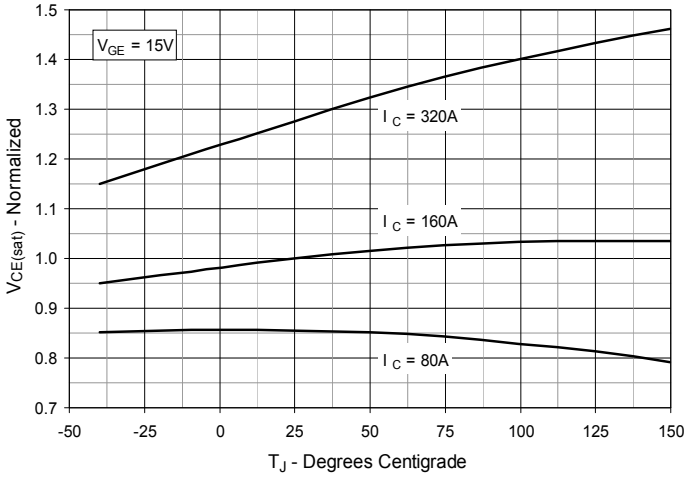



**Fig. 4. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

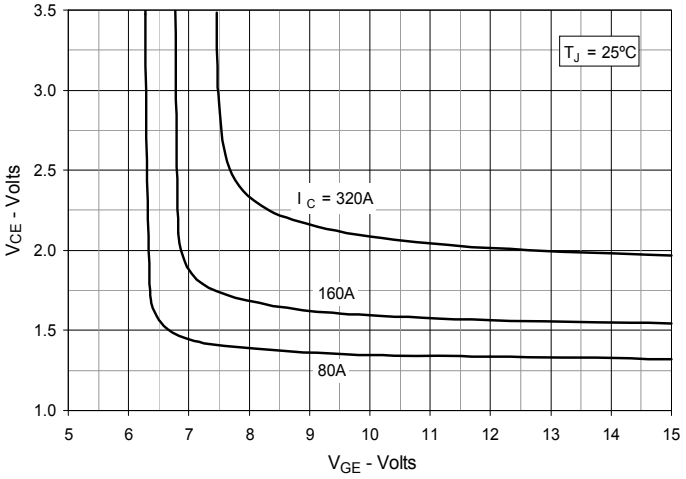



**Fig. 5. Input Admittance**

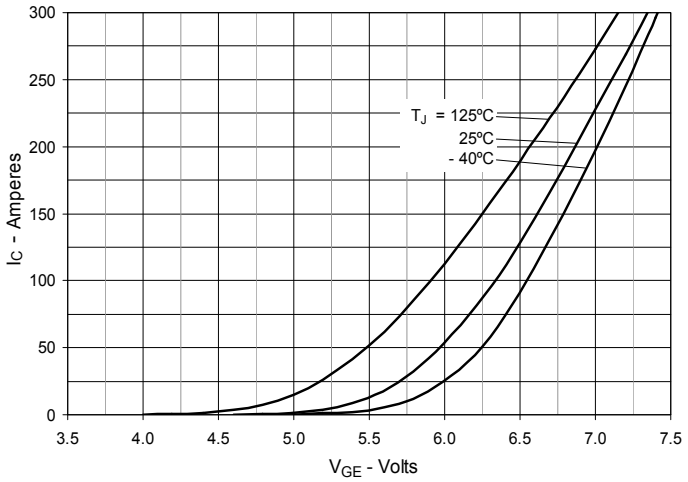
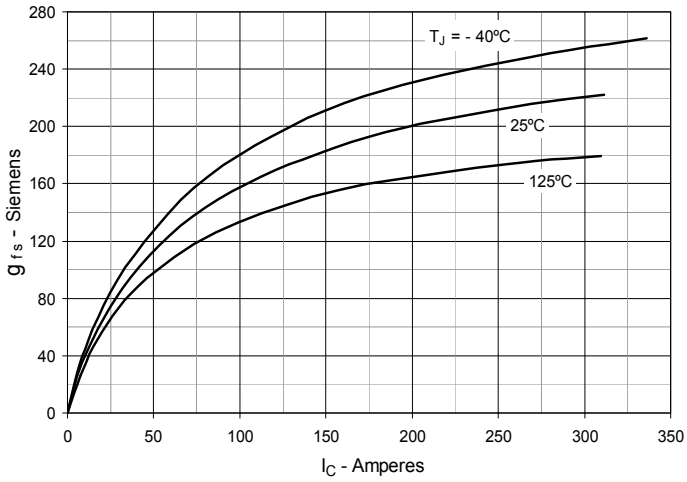



**Fig. 6. Transconductance**




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**Fig. 7. Gate Charge**

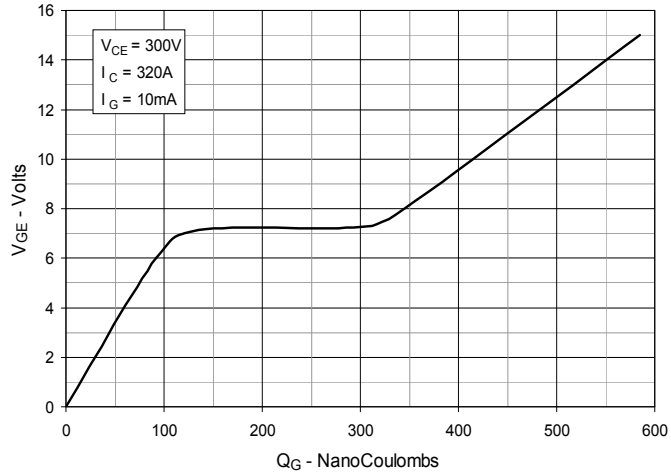



**Fig. 8. Capacitance**

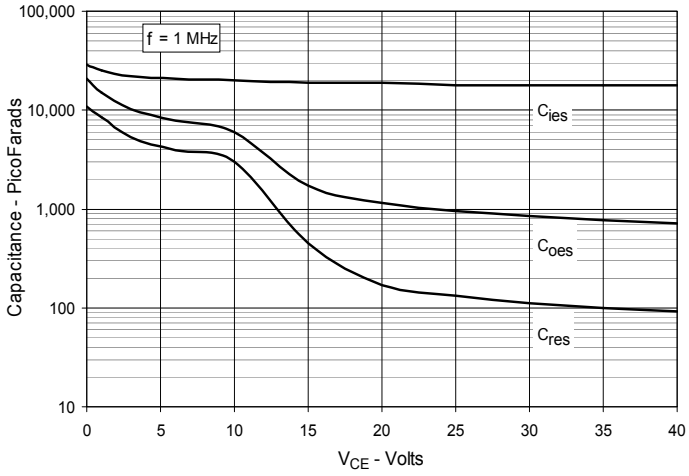



**Fig. 9. Reverse-Bias Safe Operating Area**

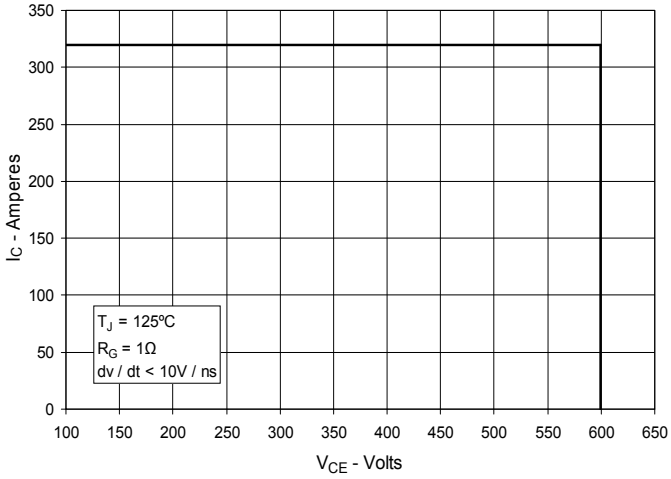



**Fig. 10. Maximum Transient Thermal Impedance**

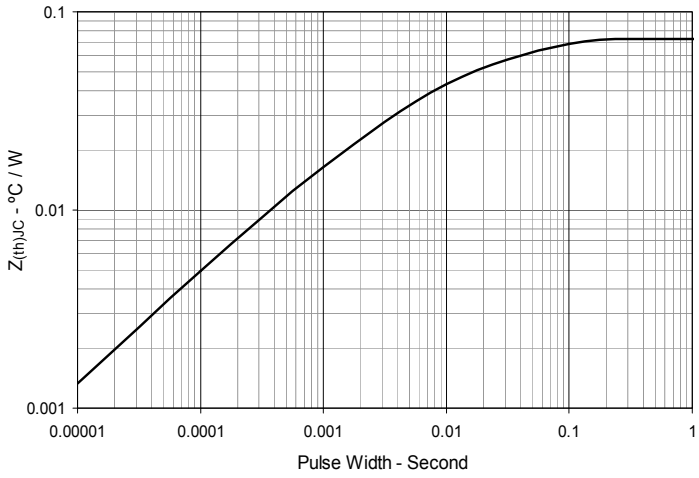


**Fig. 11. Inductive Switching Energy Loss vs. Gate Resistance**

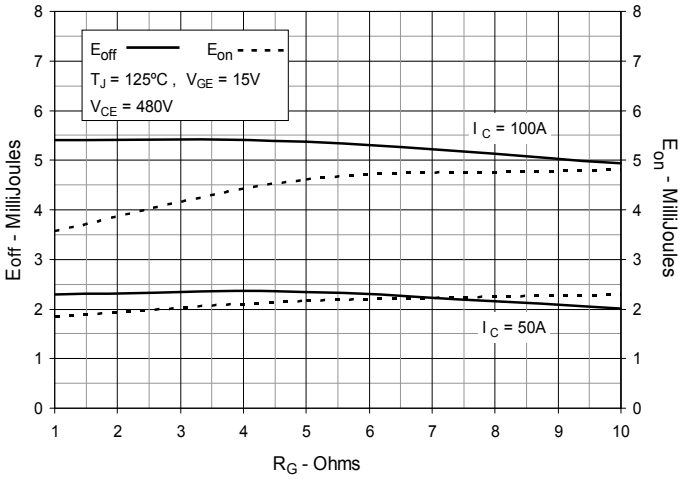



**Fig. 12. Inductive Switching Energy Loss vs. Collector Current**

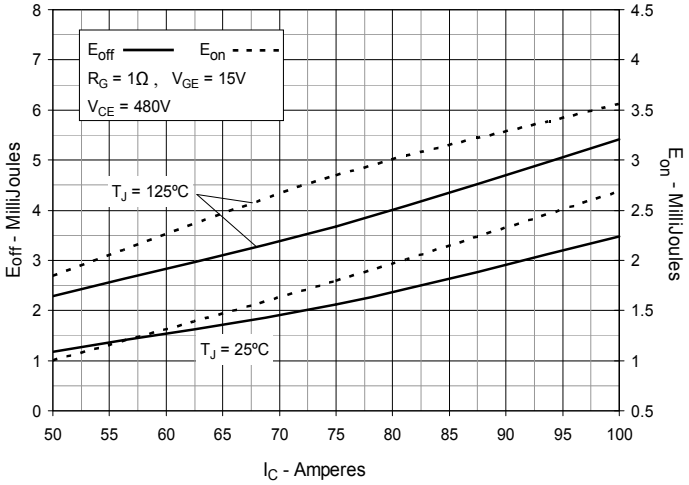



**Fig. 13. Inductive Switching Energy Loss vs. Junction Temperature**

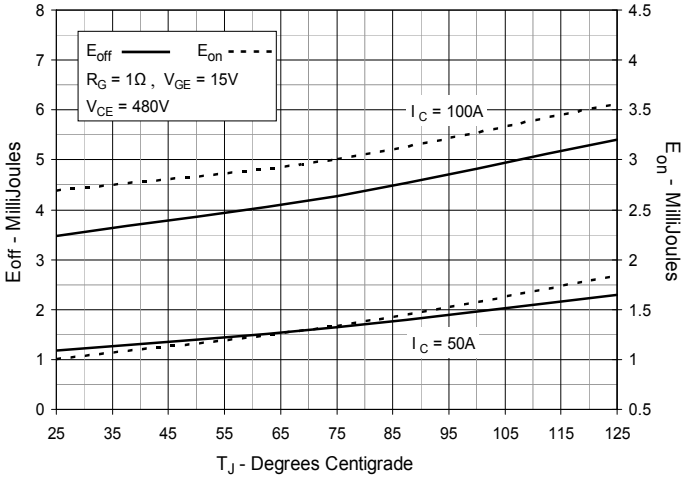



**Fig. 14. Inductive Turn-off Switching Times vs. Gate Resistance**

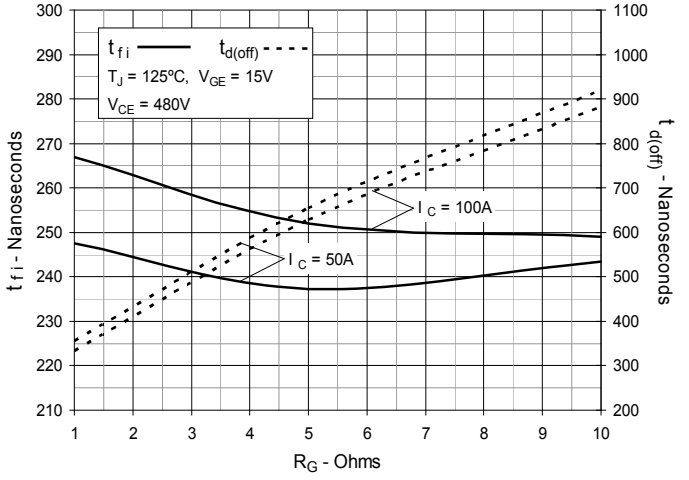



**Fig. 15. Inductive Turn-off Switching Times vs. Collector Current**

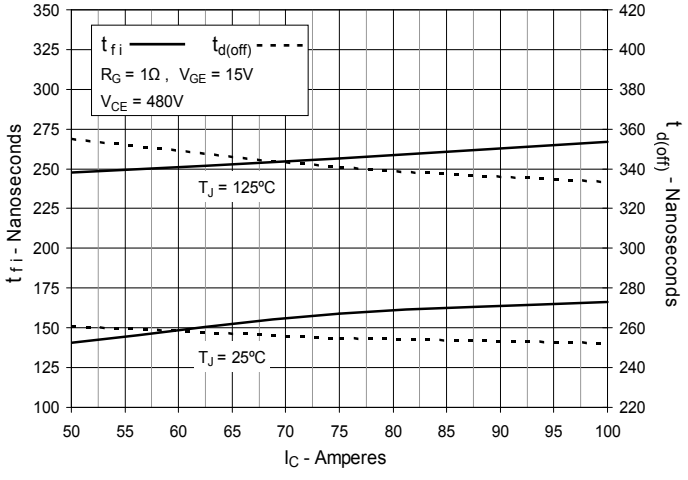
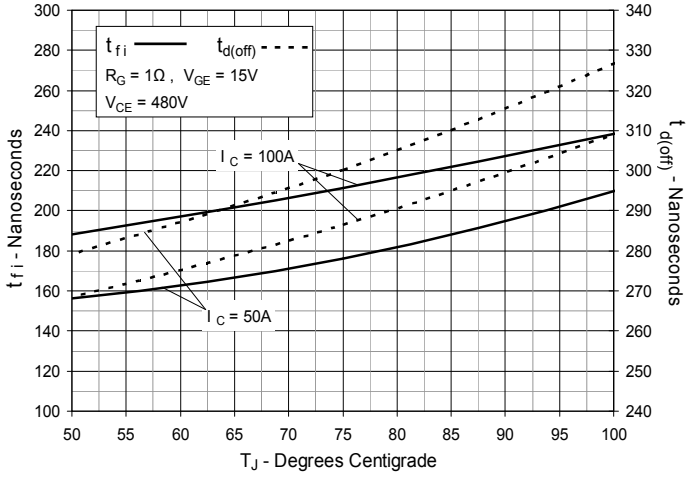



**Fig. 16. Inductive Turn-off Switching Times vs. Junction Temperature**




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**Fig. 17. Inductive Turn-on Switching Times vs. Gate Resistance**

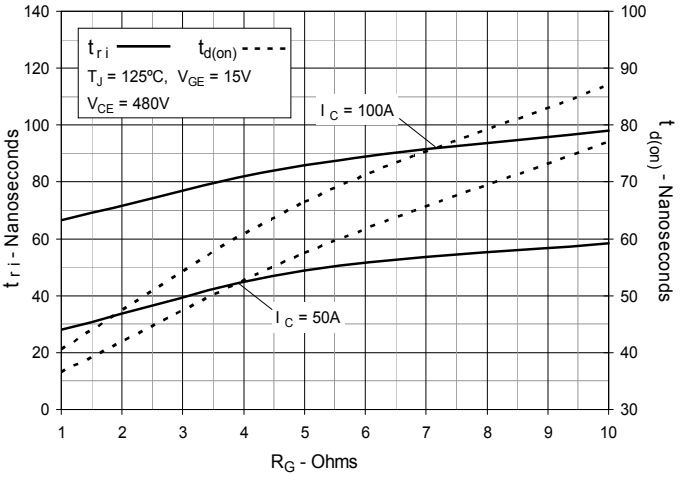



**Fig. 18. Inductive Turn-on Switching Times vs. Collector Current**

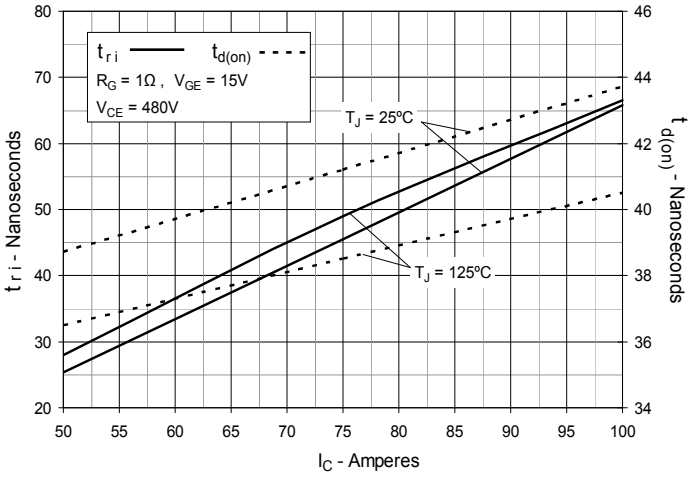
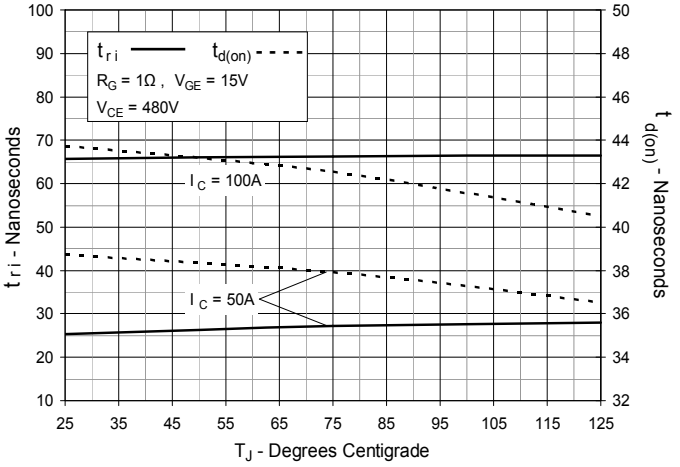



**Fig. 19. Inductive Turn-on Switching Times vs. Junction Temperature**




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