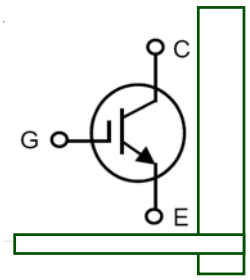
# XPT™ 650V IGBT
# GenX3™

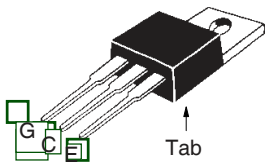
## IXYP30N65C3
## IXYH30N65C3

$V_{CES}$ = 650V
$I_{C110}$ = 30A
$V_{CE(sat)}$ ≤ 2.7V
$t_{fi(typ)}$ = 24ns

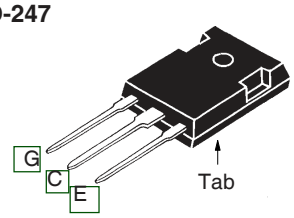
Extreme Light Punch Through
IGBT for 20-60kHz Switching




**TO-220**




**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 | 60 | A |
| $I_{C110}$ | $T_C$ = 110°C | 30 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1ms | 118 | A |
| $I_A$ | $T_C$ = 25°C | 10 | A |
| $E_{AS}$ | $T_C$ = 25°C | 300 | mJ |
| SSOA (RBSOA) | $V_{GE}$ = 15V, $T_{VJ}$ = 150°C, $R_G$ = 10Ω<br>Clamped Inductive Load | $I_{CM}$ = 60<br>$V_{CE} \leq V_{CES}$ | A |
| $t_{sc}$ (SCSOA) | $V_{GE}$ = 15V, $V_{CE}$ = 360V, $T_J$ = 150°C<br>$R_G$ = 82Ω, Non Repetitive | 8 | μs |
| $P_C$ | $T_C$ = 25°C | 270 | 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 | TO-220 | 3 | g |
| | TO-247 | 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 | | | 15 | μA |
| | $T_J$ = 150°C | | | 200 | μA |
| $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ±20V | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = 30A, $V_{GE}$ = 15V, Note 1 | | 2.35 | 2.70 | V |
| | $T_J$ = 150°C | | 2.58 | | V |

### Features

- Optimized for 20-60kHz Switching
- Square RBSOA
- Avalanche Rated
- Short Circuit Capability
- International Standard Packages

### Advantages

- High Power Density
- Extremely Rugged
- Low Gate Drive Requirement

### Applications

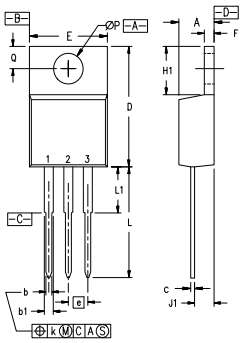
- Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts
- High Frequency Power Inverters

| Symbol | Test Conditions ($T_J$ = 25°C Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. |
|---|---|---|---|---|
| $g_{fs}$ | $I_C$ = 30A, $V_{CE}$ = 10V, Note 1 | 11 | 19 | S |
| $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 1225 | pF |
| $C_{oes}$ | | | 75 | pF |
| $C_{res}$ | | | 28 | pF |
| $Q_{g(on)}$ | $I_C$ = 30A, $V_{GE}$ = 15V, $V_{CE}$ = 0.5 • $V_{CES}$ | | 44 | nC |
| $Q_{ge}$ | | | 7 | nC |
| $Q_{gc}$ | | | 24 | nC |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 25°C** | | 21 | ns |
| $t_{ri}$ | $I_C$ = 30A, $V_{GE}$ = 15V | | 42 | ns |
| $E_{on}$ | $V_{CE}$ = 400V, $R_G$ = 10Ω | | 1.00 | mJ |
| $t_{d(off)}$ | Note 2 | | 75 | ns |
| $t_{fi}$ | | | 24 | ns |
| $E_{off}$ | | | 0.27 | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 150°C** | | 19 | ns |
| $t_{ri}$ | $I_C$ = 30A, $V_{GE}$ = 15V | | 40 | ns |
| $E_{on}$ | $V_{CE}$ = 400V, $R_G$ = 10Ω | | 1.50 | mJ |
| $t_{d(off)}$ | Note 2 | | 90 | ns |
| $t_{fi}$ | | | 30 | ns |
| $E_{off}$ | | | 0.41 | mJ |
| $R_{thJC}$ | | | | 0.55 °C/W |
| $R_{thCS}$ | TO-220 | | 0.50 | °C/W |
| $R_{thCS}$ | TO-247 | | 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 $R_G$.

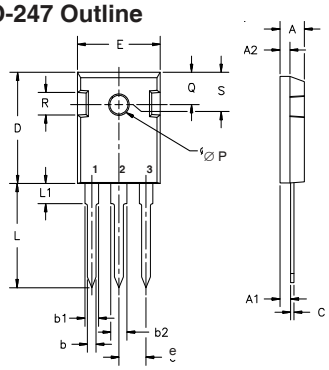
**TO-220 Outline**




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 |

**TO-247 Outline**




Terminals: 1 - Gate 2 - Collector
3 - Emitter

| Dim. | Millimeter Min. | Millimeter Max. | Inches Min. | Inches 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 | |

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

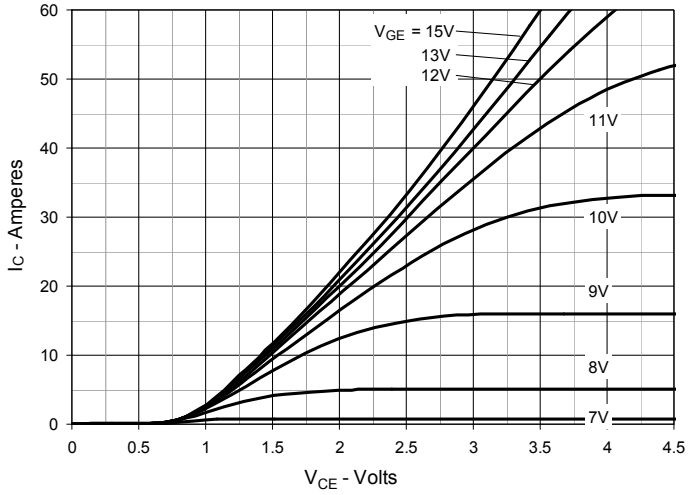



**Fig. 2. Extended Output Characteristics @ $T_J$ = 25ºC**

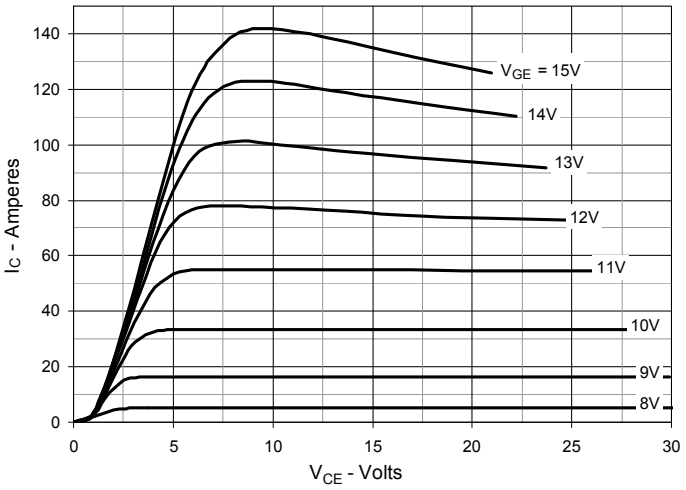



**Fig. 3. Output Characteristics @ $T_J$ = 150ºC**

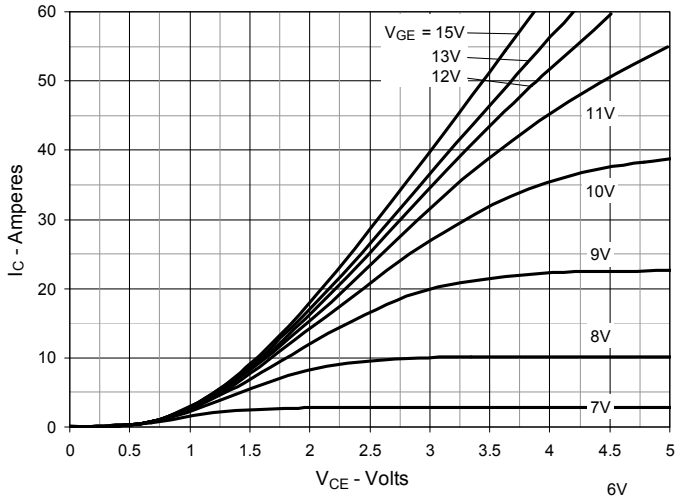



**Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature**

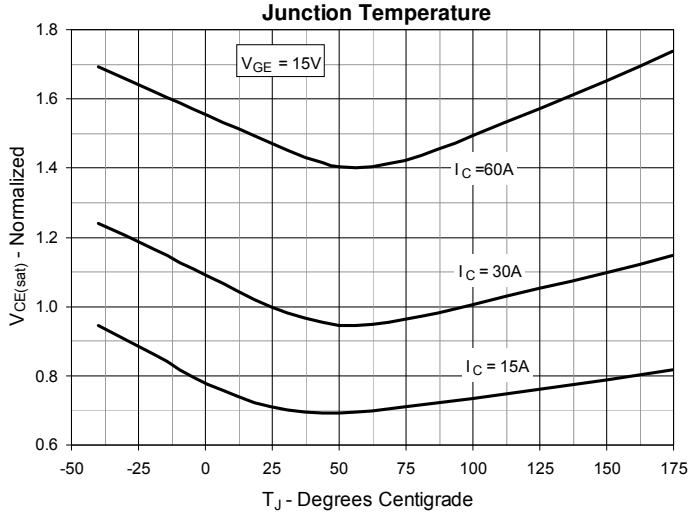



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

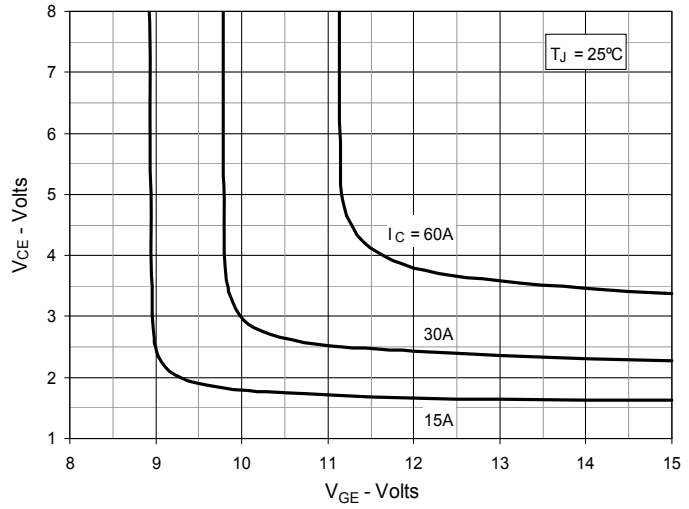



**Fig. 6. Input Admittance**

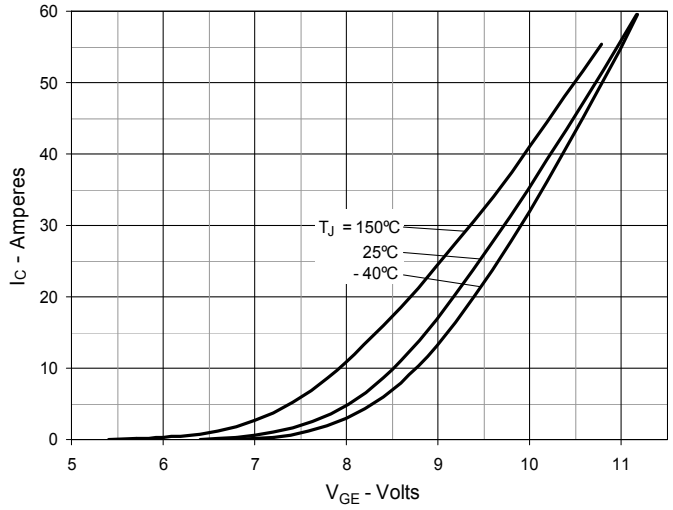


**Fig. 7. Transconductance**

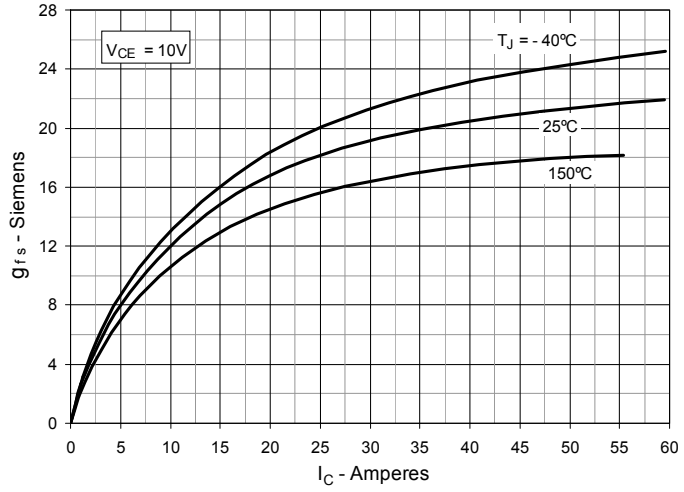



**Fig. 8. Gate Charge**

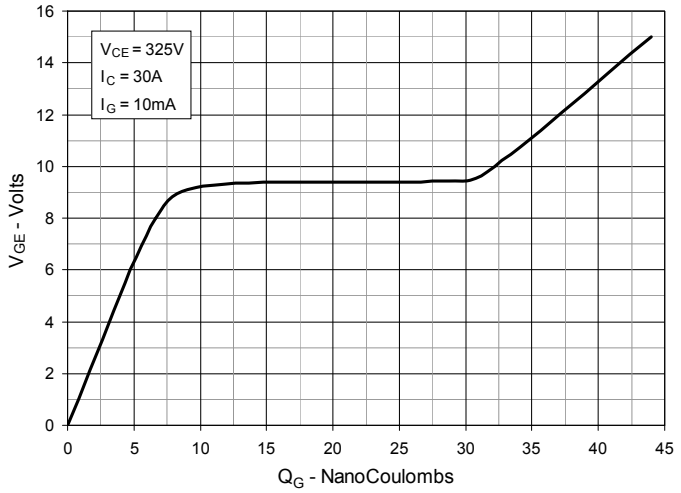



**Fig. 9. Capacitance**

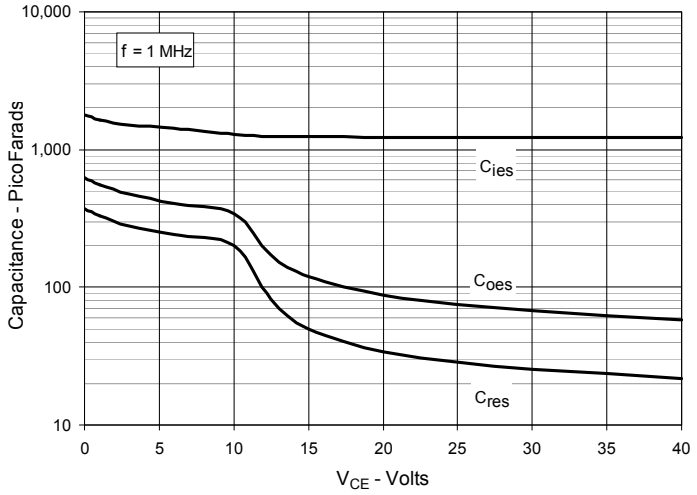



**Fig. 10. Reverse-Bias Safe Operating Area**

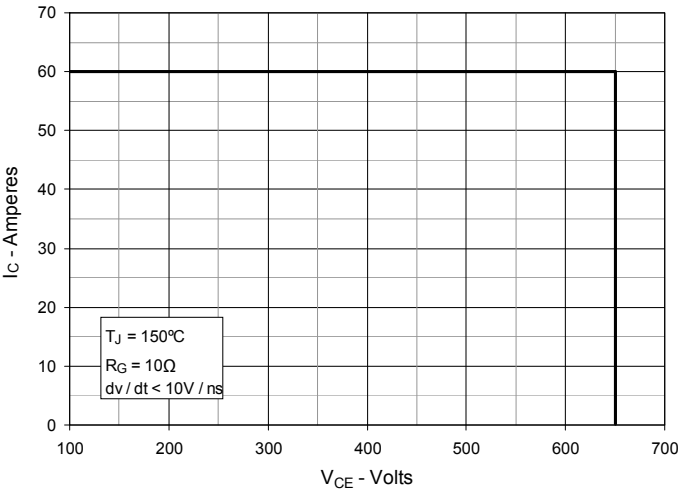



**Fig. 11. Maximum Transient Thermal Impedance**

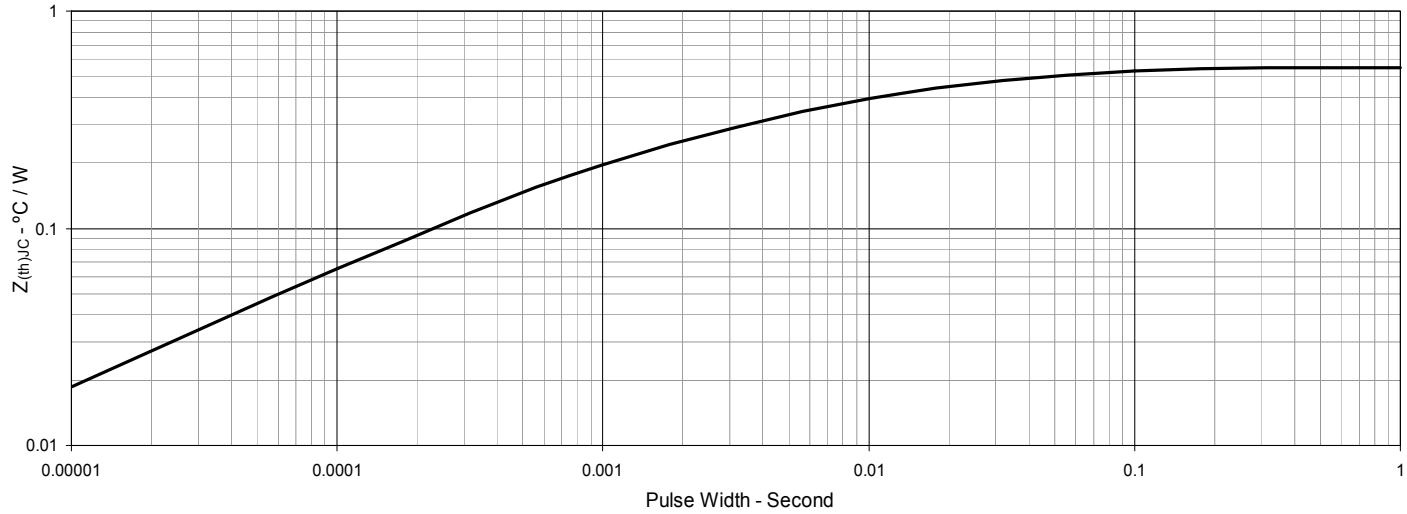


**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**

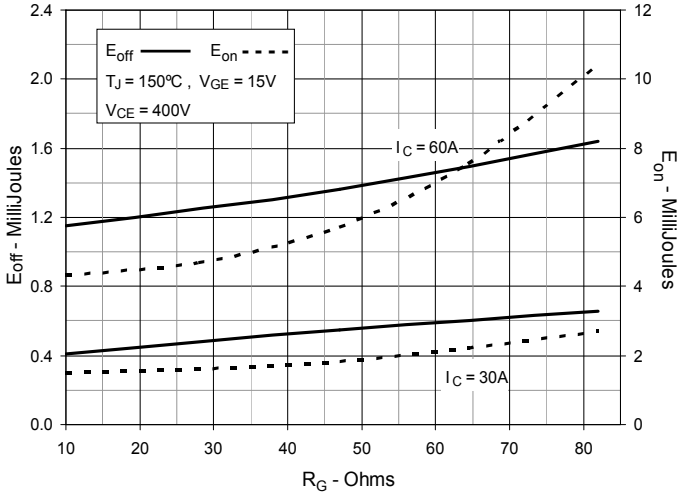



**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**

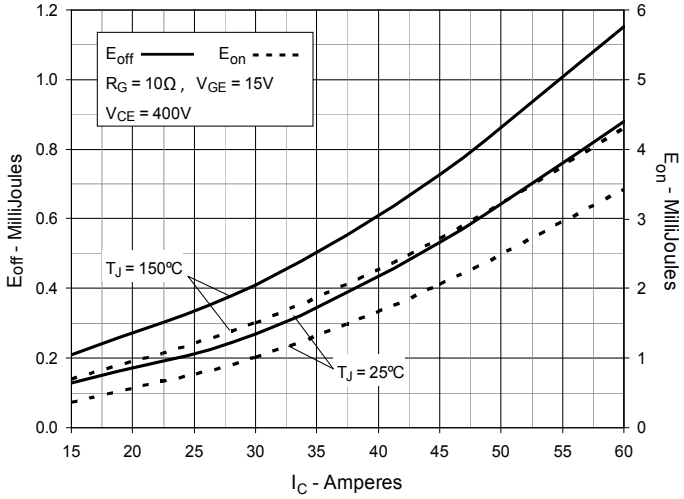



**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**

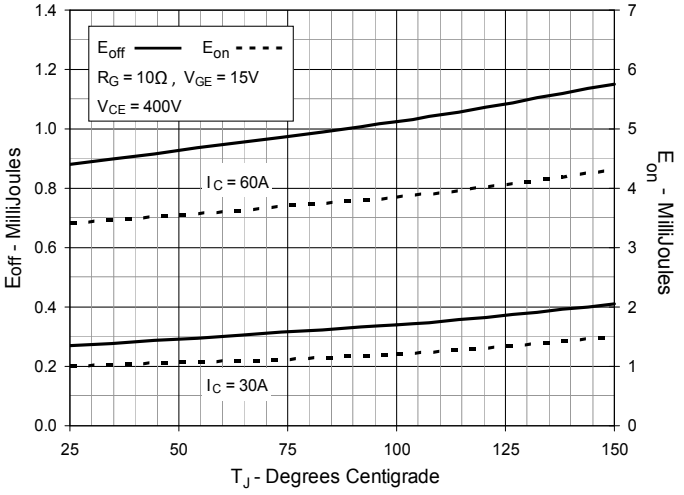



**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**

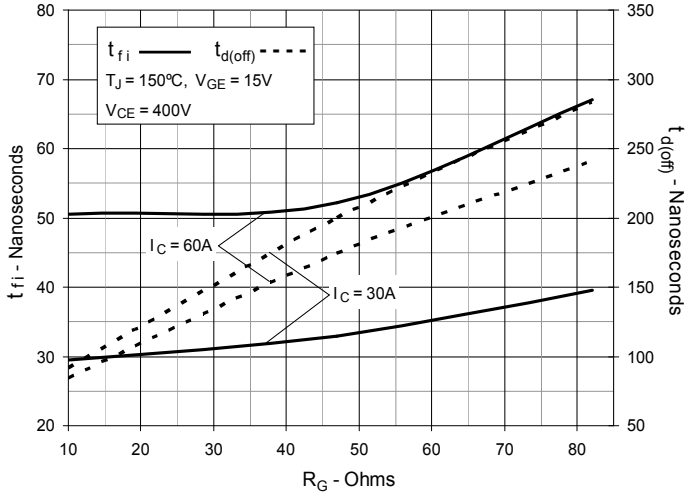



**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**

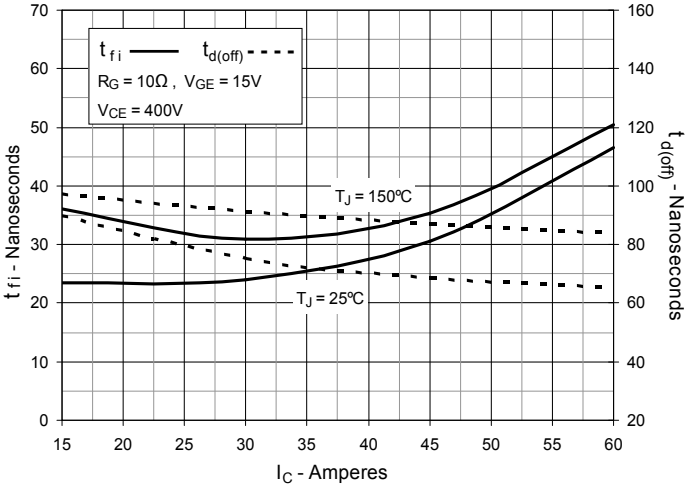



**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**

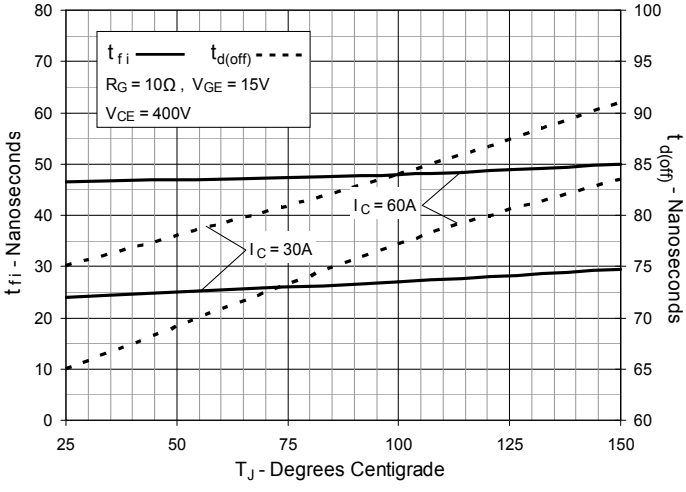


**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**

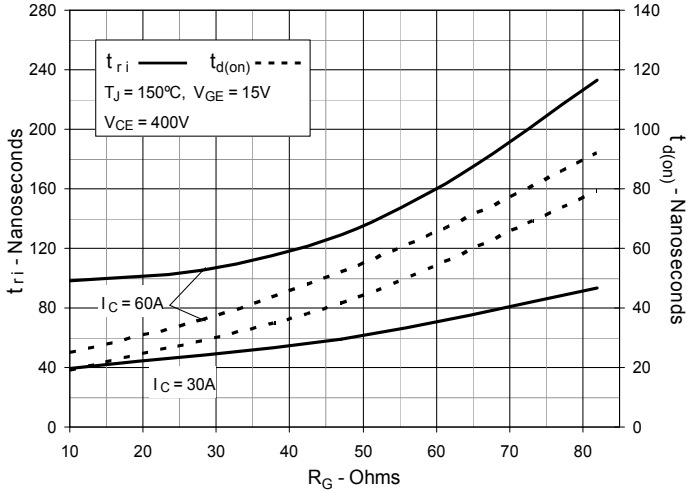



**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**

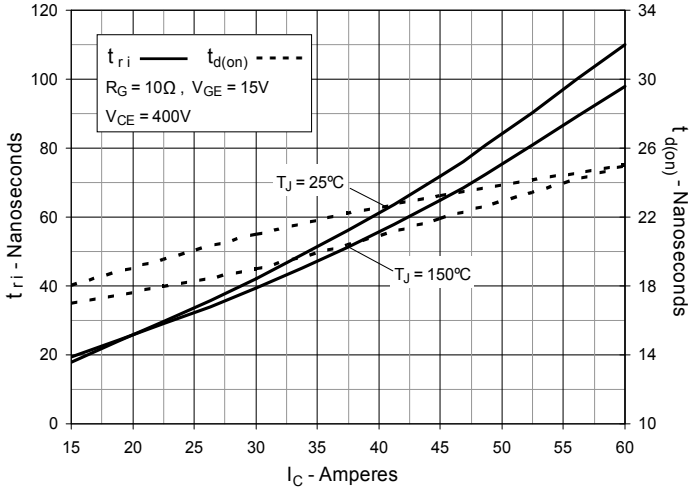



**Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature**

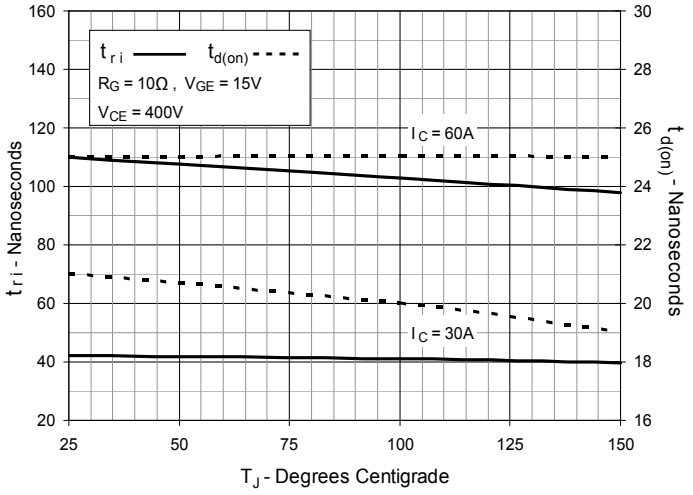



**Fig. 21. Maximum Peak Load Current vs. Frequency**