IXYS

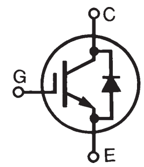
Advance Technical Information

# $XPT^{TM}$ 650V IGBT GenX3™ w/ Diode

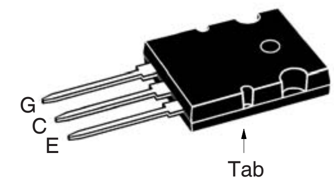
# IXYK100N65B3D1 IXYX100N65B3D1

$V_{CES}$ = 650V
$I_{C110}$ = 100A
$V_{CE(sat)}$ ≤ 1.85V
$t_{fi(typ)}$ = 73ns

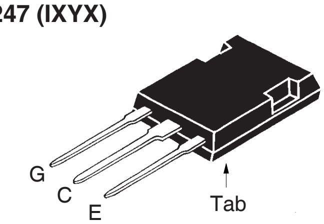
Extreme Light Punch Through
IGBT for 10-30kHz Switching




TO-264 (IXYK)




PLUS247 (IXYX)




G = Gate E = Emitter
C = Collector 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) | 225 | A |
| $I_{LRMS}$ | Terminal Current Limit | 160 | A |
| $I_{C110}$ | $T_C$ = 110°C | 100 | A |
| $I_{F110}$ | $T_C$ = 110°C | 67 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1ms | 460 | A |
| $I_A$ | $T_C$ = 25°C | 50 | A |
| $E_{AS}$ | $T_C$ = 25°C | 600 | mJ |
| SSOA (RBSOA) | $V_{GE}$ = 15V, $T_{VJ}$ = 150°C, $R_G$ = 3Ω Clamped Inductive Load | $I_{CM}$ = 200 @$V_{CE} \leq V_{CES}$ | A |
| $t_{sc}$ (SCSOA) | $V_{GE}$ = 15V, $V_{CE}$ = 360V, $T_J$ = 150°C $R_G$ = 10Ω, Non Repetitive | 8 | µs |
| $P_C$ | $T_C$ = 25°C | 830 | 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 (TO-264) | 1.13/10 | Nm/lb.in |
| $F_C$ | Mounting Force (PLUS247) | 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. | |
|---|---|---|---|---|---|
| $BV_{CES}$ | $I_C$ = 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 | | | 50 | µA |
| | $T_J$ = 150°C | | | 3 | mA |
| $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ±20V | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = 70A, $V_{GE}$ = 15V, Note 1 | | 1.53 | 1.85 | V |
| | $T_J$ = 150°C | | 1.77 | | V |

## Features

- International Standard Packages
- Optimized for 10-30kHz Switching
- Square RBSOA
- Avalanche Rated
- Short Circuit Capability
- Anti-Parallel Ultra Fast Diode
- High Current Handling Capability

## 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 | 30 | 55 | | S |
| $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 4740 | | pF |
| $C_{oes}$ | | | 470 | | pF |
| $C_{res}$ | | | 103 | | pF |
| $Q_{g(on)}$ | $I_C$ = 100A, $V_{GE}$ = 15V, $V_{CE}$ = 0.5 • $V_{CES}$ | | 168 | | nC |
| $Q_{ge}$ | | | 30 | | nC |
| $Q_{gc}$ | | | 78 | | nC |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 25°C** | | 29 | | ns |
| $t_{ri}$ | $I_C$ = 50A, $V_{GE}$ = 15V | | 37 | | ns |
| $E_{on}$ | $V_{CE}$ = 400V, $R_G$ = 3Ω | | 1.27 | | mJ |
| $t_{d(off)}$ | Note 2 | | 150 | | ns |
| $t_{fi}$ | | | 73 | | ns |
| $E_{off}$ | | | 1.37 | 2.00 | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 150°C** | | 28 | | ns |
| $t_{ri}$ | $I_C$ = 50A, $V_{GE}$ = 15V | | 37 | | ns |
| $E_{on}$ | $V_{CE}$ = 400V, $R_G$ = 3Ω | | 2.35 | | mJ |
| $t_{d(off)}$ | Note 2 | | 198 | | ns |
| $t_{fi}$ | | | 160 | | ns |
| $E_{off}$ | | | 2.16 | | mJ |
| $R_{thJC}$ | | | | 0.18 | °C/W |
| $R_{thCS}$ | | | 0.15 | | °C/W |

## Reverse Diode (FRED)

| Symbol | Test Conditions ($T_J$ = 25°C Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $V_F$ | $I_F$ = 100A, $V_{GE}$ = 0V, Note 1 | | 1.7 | 2.7 | V |
| | $T_J$ = 150°C | | 1.4 | | V |
| $I_{RM}$ | $I_F$ = 100A, $V_{GE}$ = 0V, $T_J$ = 150°C, | | 45 | | A |
| $t_{rr}$ | $-di_F/dt$ = 700A/µs, $V_R$ = 400V | | 156 | | ns |
| $R_{thJC}$ | | | | 0.36 | °C/W |

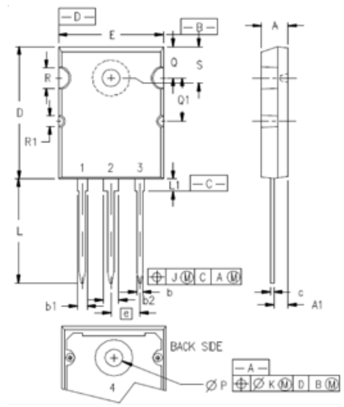
Notes:

1. Pulse test, t ≤ 300µs, duty cycle, d ≤ 2%.
2. Switching times & energy losses may increase for higher $V_{CE}$(clamp), $T_J$ or $R_G$.

**ADVANCE 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.

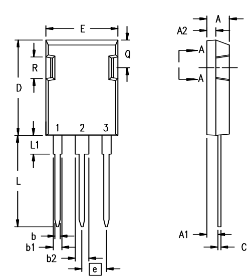
### TO-264 Outline



Terminals: 1 = Gate
2,4 = Collector
3 = Emitter

| SYM | INCHES MIN | MAX | MILLIMETERS MIN | MAX |
|---|---|---|---|---|
| A | .185 | .209 | 4.70 | 5.31 |
| A1 | .102 | .118 | 2.59 | 3.00 |
| b | .037 | .055 | 0.94 | 1.40 |
| b1 | .087 | .102 | 2.21 | 2.59 |
| b2 | .110 | .126 | 2.79 | 3.20 |
| c | .017 | .029 | 0.43 | 0.74 |
| D | 1.007 | 1.047 | 25.58 | 26.59 |
| E | .760 | .799 | 19.30 | 20.29 |
| e | .215BSC | | 5.46 BSC | |
| J | .000 | .010 | 0.00 | 0.25 |
| K | .000 | .010 | 0.00 | 0.25 |
| L | .779 | .842 | 19.79 | 21.39 |
| L1 | .087 | .102 | 2.21 | 2.59 |
| ØP | .122 | .138 | 3.10 | 3.51 |
| Q | .240 | .256 | 6.10 | 6.50 |
| Q1 | .330 | .346 | 8.38 | 8.79 |
| ØR | .155 | .187 | 3.94 | 4.75 |
| ØR1 | .085 | .093 | 2.16 | 2.36 |
| S | .243 | .253 | 6.17 | 6.43 |

### PLUS247™ 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 |

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

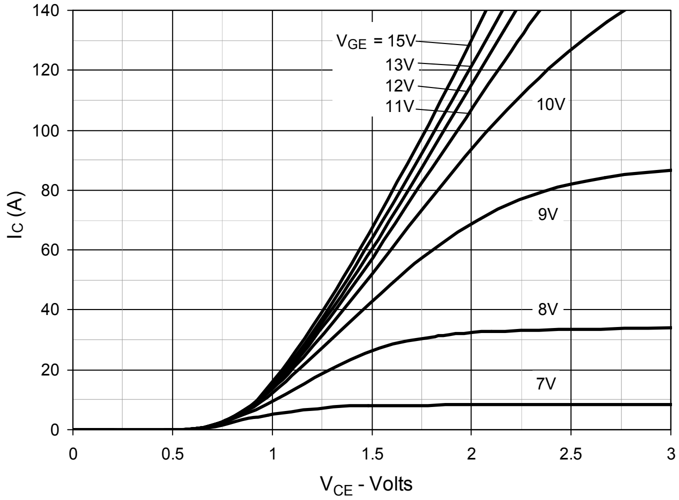



**Fig. 2. Extended Output Characteristics @ $T_J$ = 25ºC**

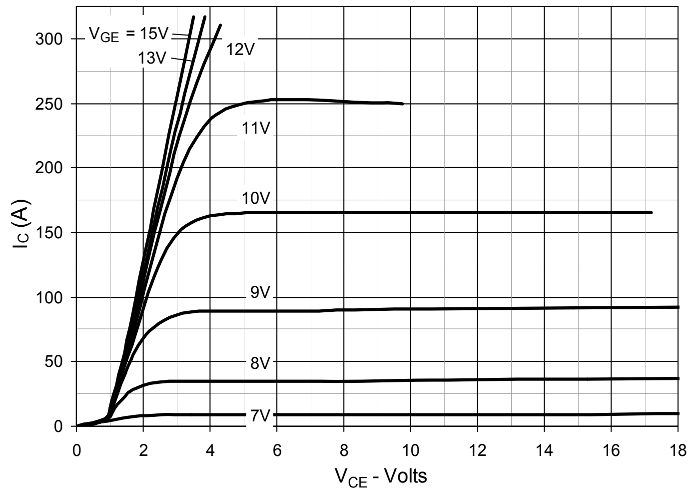



**Fig. 3. Output Characteristics @ $T_J$ = 150ºC**

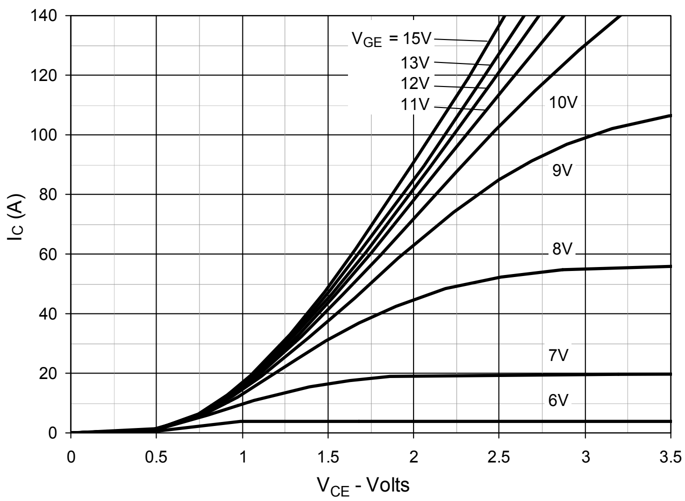



**Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature**

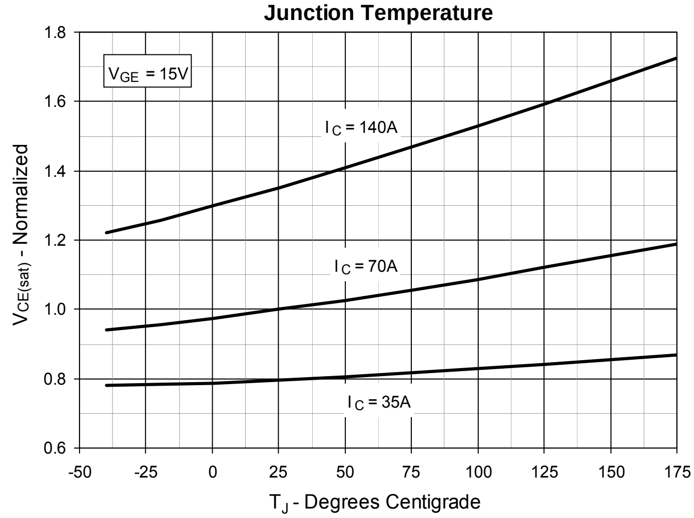



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

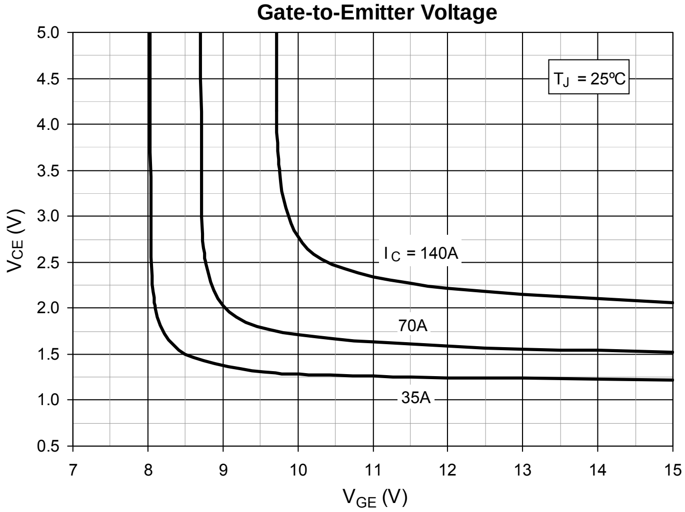



**Fig. 6. Input Admittance**

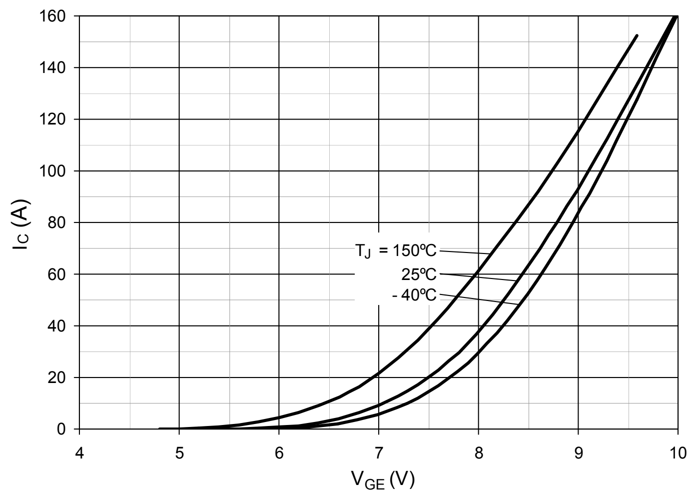


**Fig. 7. Transconductance**

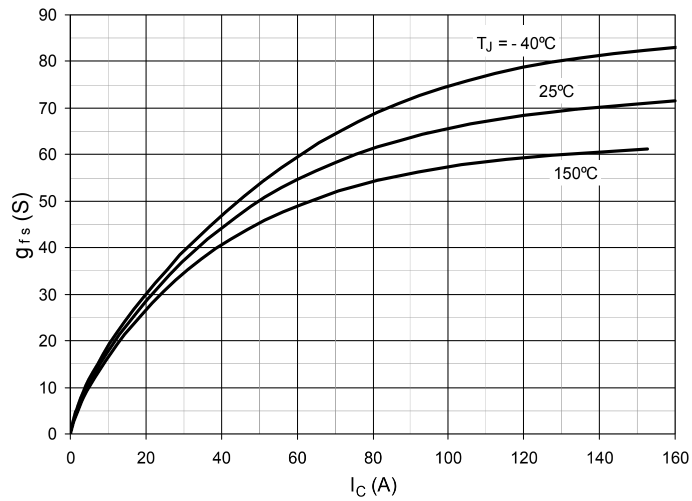



**Fig. 8. Gate Charge**

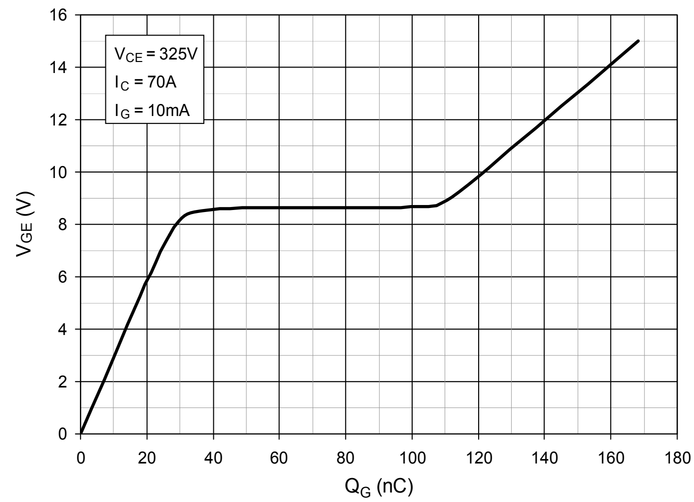



**Fig. 9. Capacitance**

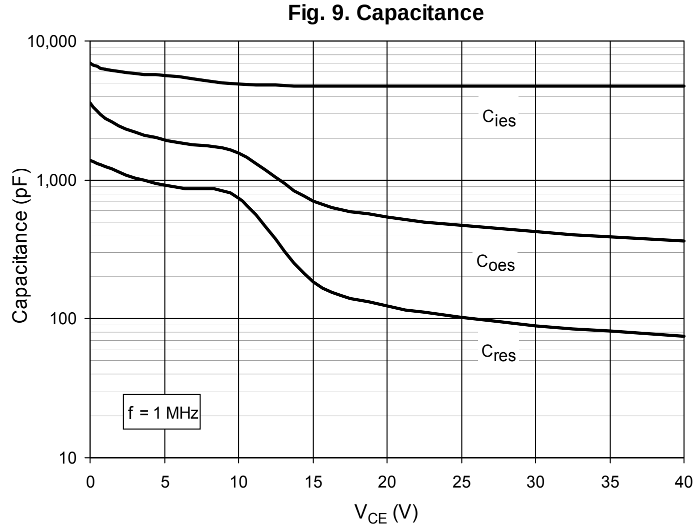



**Fig. 10. Reverse-Bias Safe Operating Area**

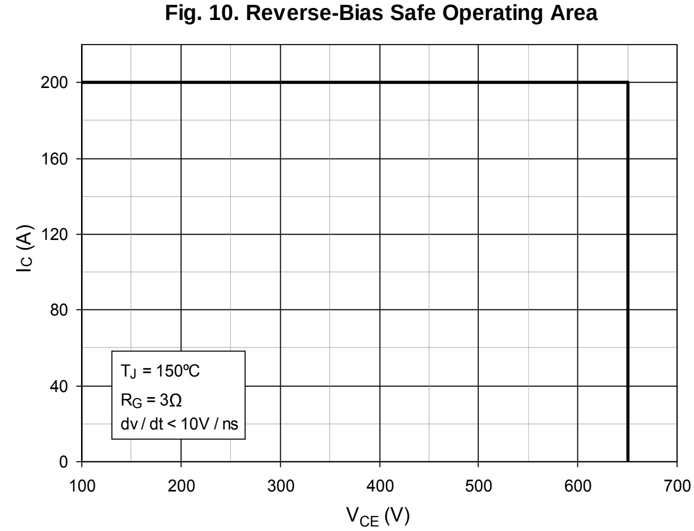



**Fig. 11. Forward-Bias Safe Operating Area**

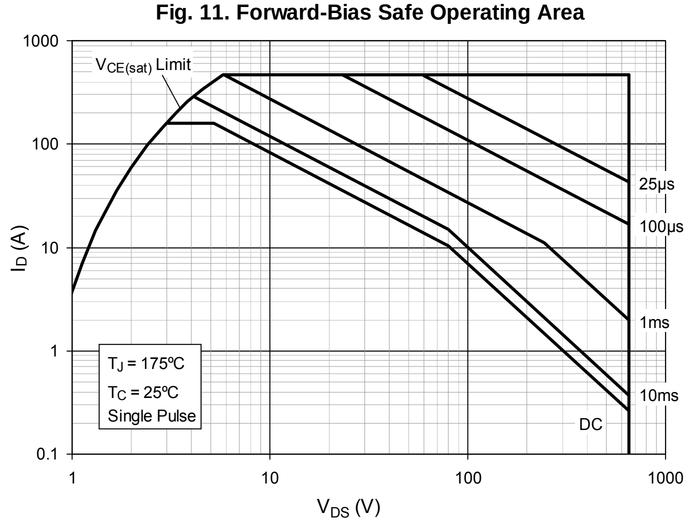
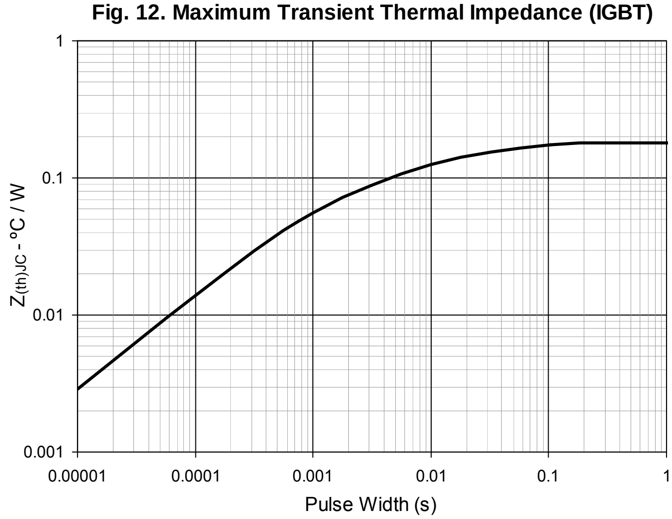



**Fig. 12. Maximum Transient Thermal Impedance (IGBT)**




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

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

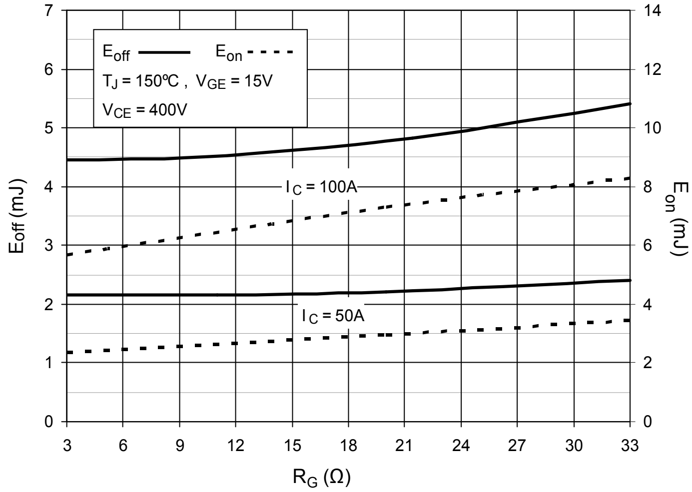



**Fig. 14. Inductive Switching Energy Loss vs. Collector Current**

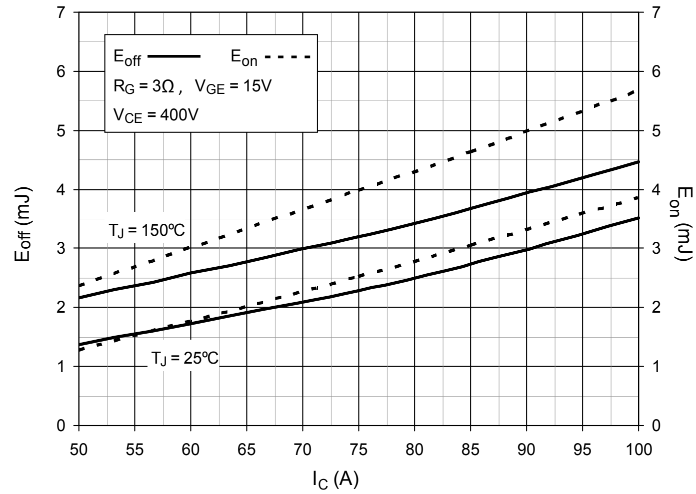



**Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature**

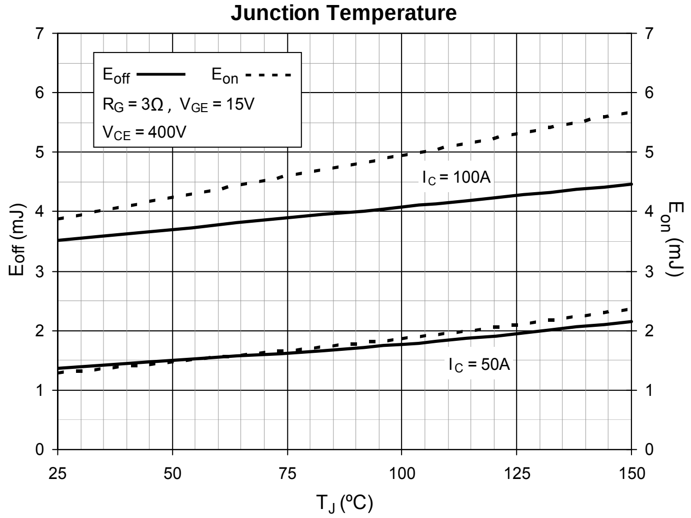



**Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance**

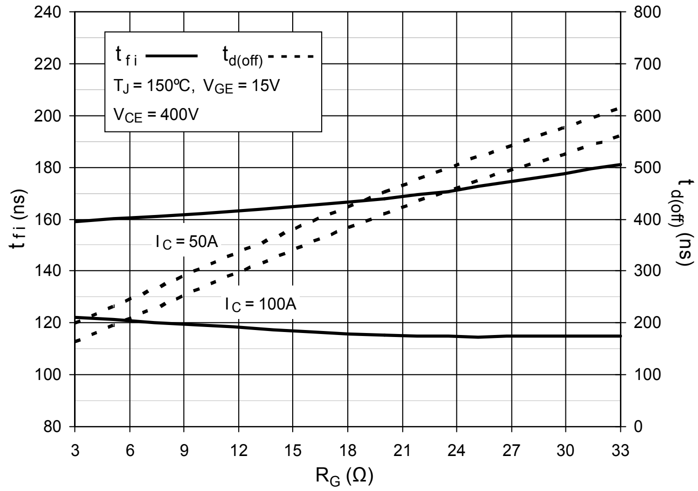



**Fig. 17. Inductive Turn-off Switching Times vs. Collector Current**

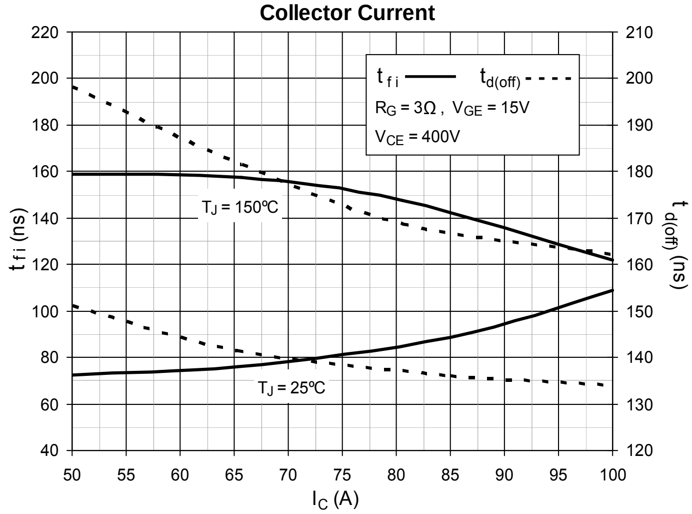



**Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature**

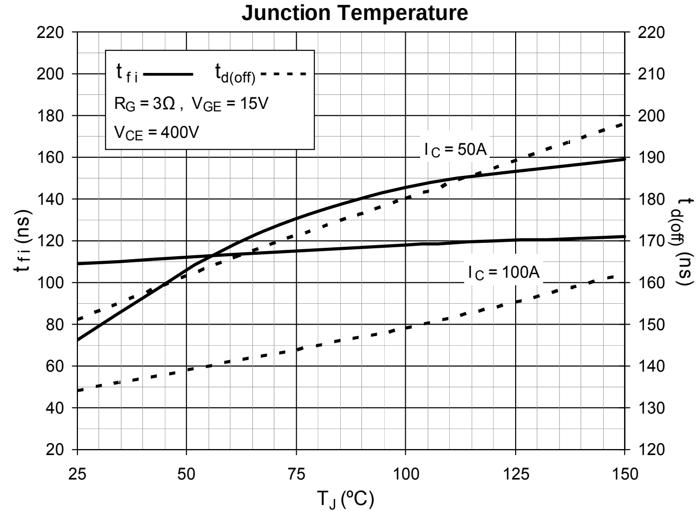


**Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance**

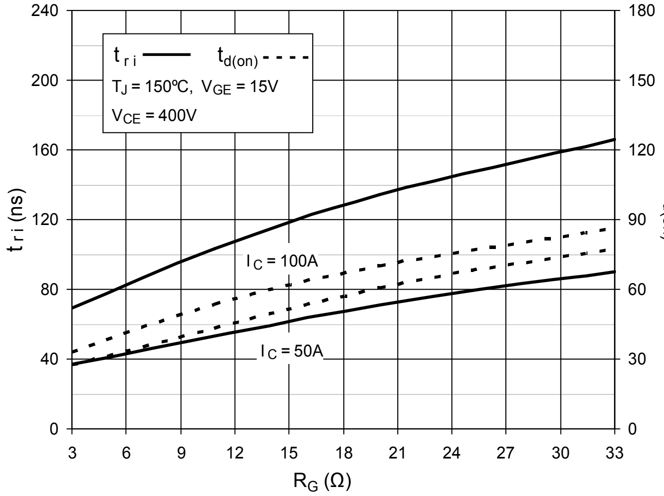



**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**

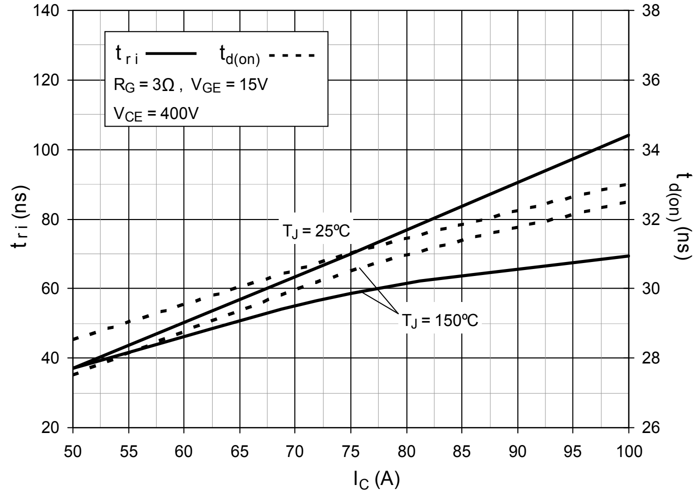



**Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature**

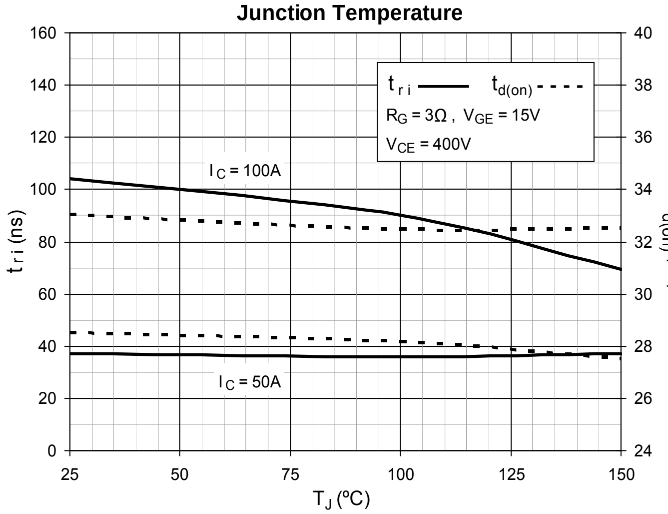



**Fig. 22. Maximum Peak Load Current vs. Frequency**

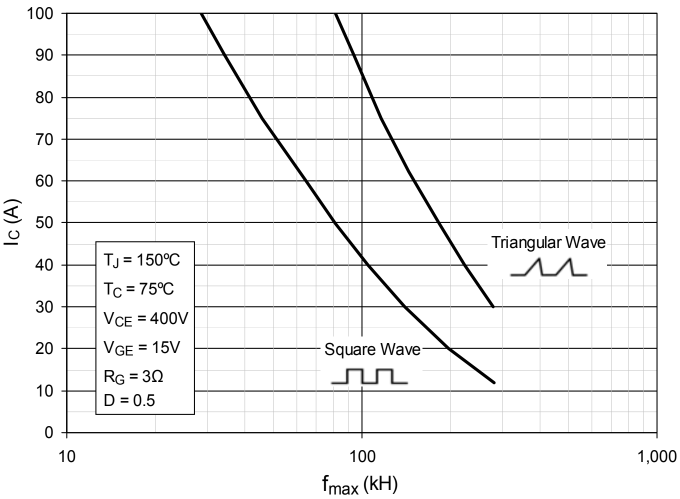


**Fig. 23. Diode Forward Characteristics**

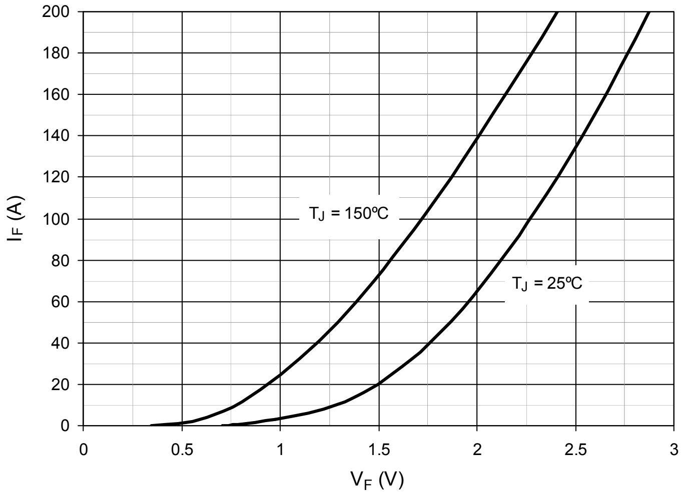



**Fig. 24. Reverse Recovery Charge vs. -di$_F$/dt**

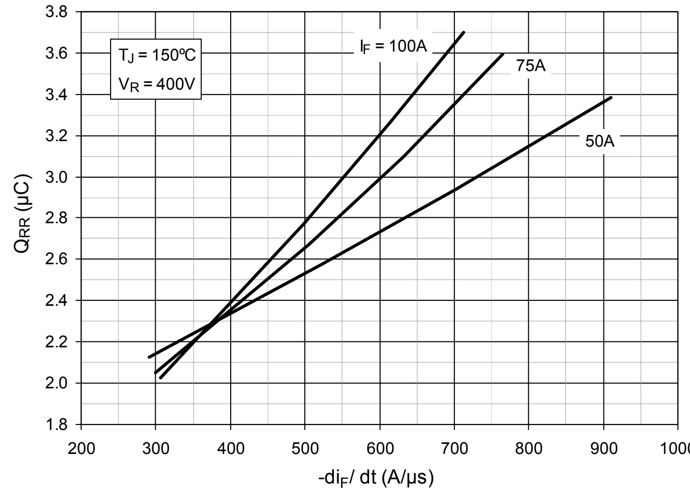



**Fig. 25. Reverse Recovery Current vs. -di$_F$/dt**

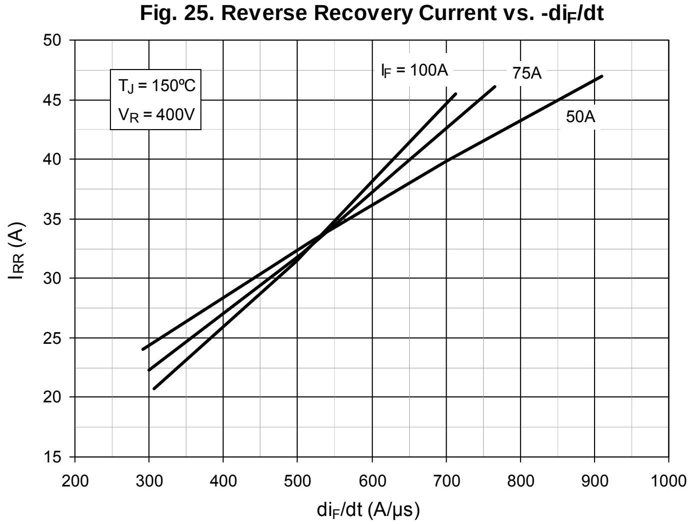



**Fig. 26. Reverse Recovery Time vs. -di$_F$/dt**

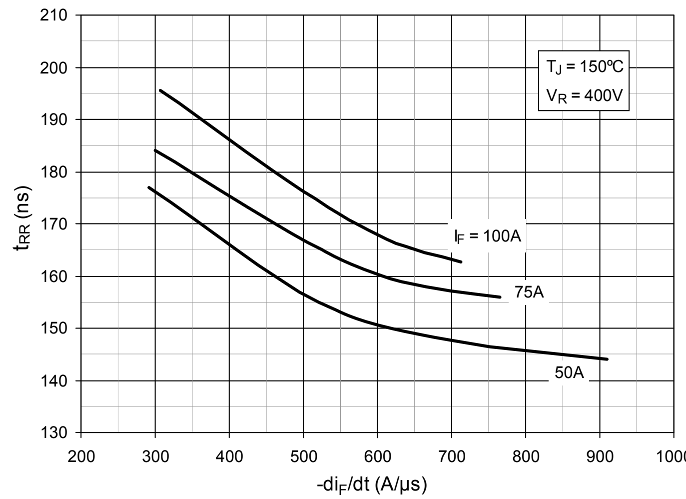



**Fig. 27. Dynamic Parameters $Q_{RR}$, $I_{RR}$ vs. Junction Temperature**

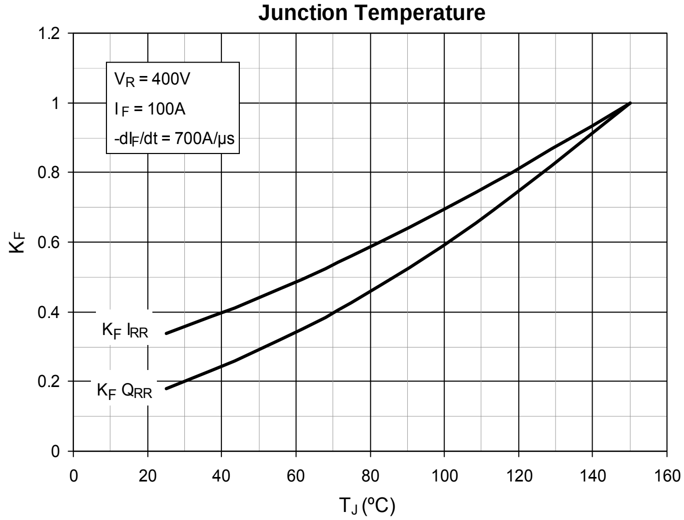



**Fig. 28. Maximum Transient Thermal Impedance (Diode)**