# IXYS

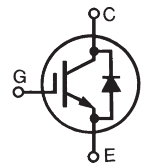
Preliminary Technical Information

# XPT™ 650V IGBT GenX3™ w/ Sonic Diode

# IXYH75N65C3H1

$V_{CES}$ = 650V
$I_{C110}$ = 75A
$V_{CE(sat)}$ ≤ 2.3V
$t_{fi(typ)}$ = 50ns

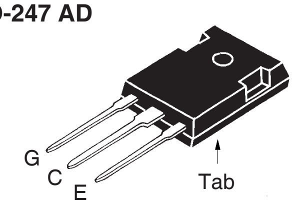
Extreme Light Punch through IGBT for 20-60kHz Switching




| 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) | 170 | A |
| $I_{LRMS}$ | Terminal Current Limit | 160 | A |
| $I_{C110}$ | $T_C$ = 110°C | 75 | A |
| $I_{F110}$ | $T_C$ = 110°C | 62 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1ms | 360 | A |
| $I_A$ | $T_C$ = 25°C | 30 | A |
| $E_{AS}$ | $T_C$ = 25°C | 300 | mJ |
| SSOA (RBSOA) | $V_{GE}$ = 15V, $T_{VJ}$ = 150°C, $R_G$ = 3Ω<br>Clamped Inductive Load | $I_{CM}$ = 150<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 | 750 | 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 | | 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 | | | 4 | mA |
| $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ±20V | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = 60A, $V_{GE}$ = 15V, Note 1 | | 1.8 | 2.3 | V |
| | $T_J$ = 150°C | | 2.2 | | V |

**TO-247 AD**




G = Gate
E = Emitter
C = Collector
Tab = Collector

### Features

- International Standard Package
- Optimized for 20-60kHz Switching
- Square RBSOA
- Avalanche Rated
- Short Circuit Capability
- High Current Handling Capability
- Anti-Parallel Sonic Diode

### Advantages

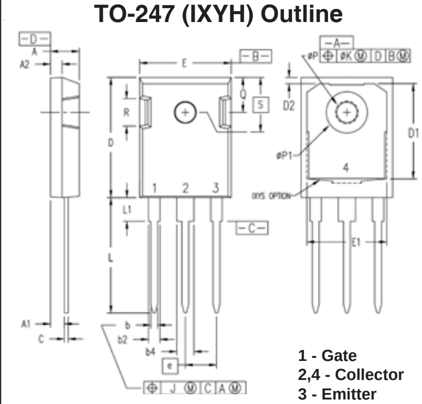
- High Power Density
- Low Gate Drive Requirement

### 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 | 25 | 42 | | S |
| $C_{ies}$ | $V_{CE} = 25V$, $V_{GE} = 0V$, f = 1MHz | | 3450 | | pF |
| $C_{oes}$ | | | 307 | | pF |
| $C_{res}$ | | | 70 | | pF |
| $Q_{g(on)}$ | $I_C = 75A$, $V_{GE} = 15V$, $V_{CE} = 0.5 \bullet V_{CES}$ | | 123 | | nC |
| $Q_{ge}$ | | | 24 | | nC |
| $Q_{gc}$ | | | 60 | | nC |
| $t_{d(on)}$ | **Inductive load, $T_J = 25°C$** | | 27 | | ns |
| $t_{ri}$ | $I_C = 60A$, $V_{GE} = 15V$ | | 67 | | ns |
| $E_{on}$ | $V_{CE} = 400V$, $R_G = 3\Omega$ | | 2.8 | | mJ |
| $t_{d(off)}$ | Note 2 | | 93 | | ns |
| $t_{fi}$ | | | 50 | | ns |
| $E_{off}$ | | | 1.0 | | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J = 150°C$** | | 26 | | ns |
| $t_{ri}$ | $I_C = 60A$, $V_{GE} = 15V$ | | 57 | | ns |
| $E_{on}$ | $V_{CE} = 400V$, $R_G = 3$ | | 3.3 | | mJ |
| $t_{d(off)}$ | Note 2 | | 108 | | ns |
| $t_{fi}$ | | | 58 | | ns |
| $E_{off}$ | | | 1.3 | | mJ |
| $R_{thJC}$ | | | | 0.20 | °C/W |
| $R_{thCS}$ | | | 0.21 | | °C/W |

**TO-247 (IXYH) Outline**




| Dim. | Millimeter min | Millimeter max | Inches min | Inches max |
|---|---|---|---|---|
| A | 4.70 | 5.30 | 0.185 | 0.209 |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 |
| A2 | 1.50 | 2.49 | 0.059 | 0.098 |
| b | 0.99 | 1.40 | 0.039 | 0.055 |
| b2 | 1.65 | 2.39 | 0.065 | 0.094 |
| b4 | 2.59 | 3.43 | 0.102 | 0.135 |
| c | 0.38 | 0.89 | 0.015 | 0.035 |
| D | 20.79 | 21.45 | 0.819 | 0.845 |
| D1 | 13.07 | - | 0.515 | - |
| D2 | 0.51 | 1.35 | 0.020 | 0.053 |
| E | 15.48 | 16.24 | 0.610 | 0.640 |
| E1 | 13.45 | - | 0.53 | - |
| E2 | 4.31 | 5.48 | 0.170 | 0.216 |
| e | 5.45 BSC | | 0.215 BSC | |
| L | 19.80 | 20.30 | 0.078 | 0.800 |
| L1 | - | 4.49 | - | 0.177 |
| Ø P | 3.55 | 3.65 | 0.140 | 0.144 |
| Ø P1 | - | 7.39 | - | 0.290 |
| Q | 5.38 | 6.19 | 0.212 | 0.244 |
| S | 6.14 BSC | | 0.242 BSC | |

**Reverse Sonic Diode (FRD)**

| Symbol | Test Conditions ($T_J = 25°C$ Unless Otherwise Specified) | | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|---|
| $V_F$ | $I_F = 50A$, $V_{GE} = 0V$, Note 1 | | | | 2.5 | V |
| | | $T_J = 150°C$ | | 1.8 | | V |
| $I_{RM}$ | $I_F = 50A$, $V_{GE} = 0V$, $-di_F/dt = 900A/\mu s$, $V_R = 300V$ | $T_J = 150°C$ | | 45 | | A |
| $t_{rr}$ | | $T_J = 150°C$ | | 150 | | ns |
| $R_{thJC}$ | | | | | 0.45 | °C/W |

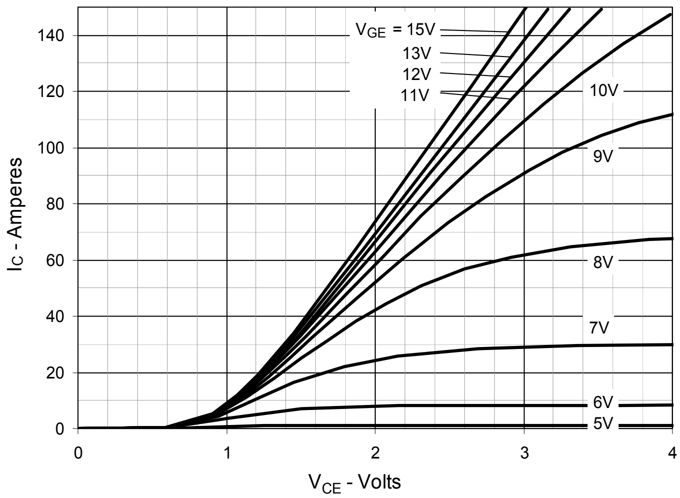
Notes:

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

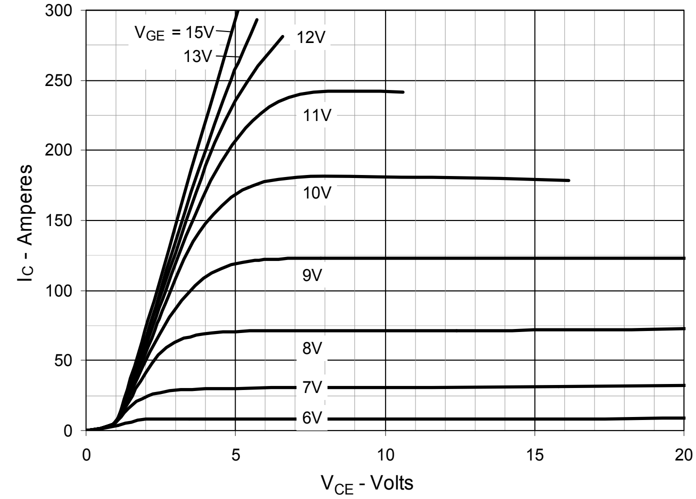
**PRELIMANARY TECHNICAL INFORMATION**

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.

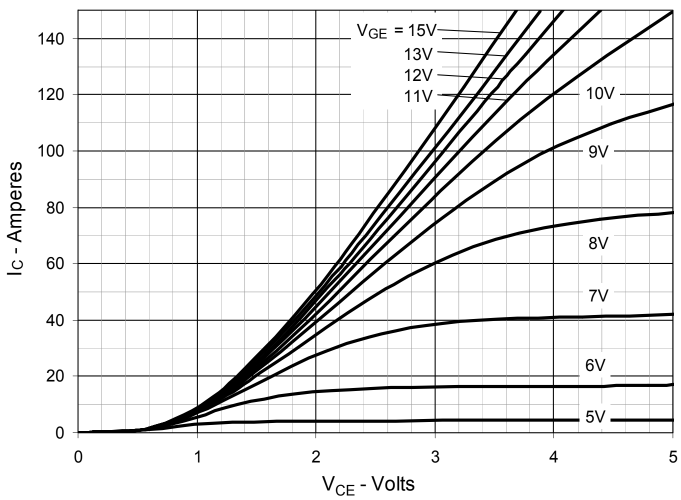
### Fig. 1. Output Characteristics @ $T_J$ = 25ºC



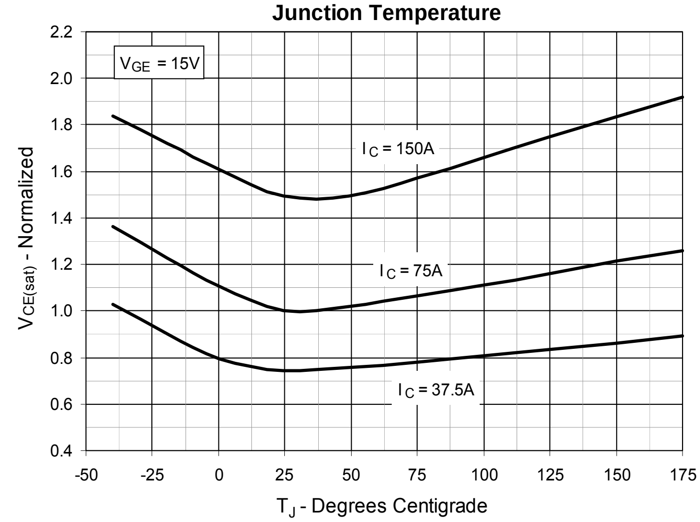

### Fig. 2. Extended Output Characteristics @ $T_J$ = 25ºC



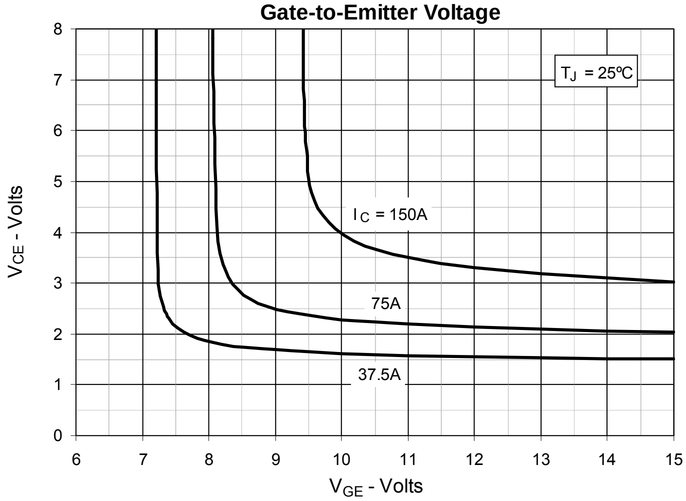

### Fig. 3. Output Characteristics @ $T_J$ = 150ºC



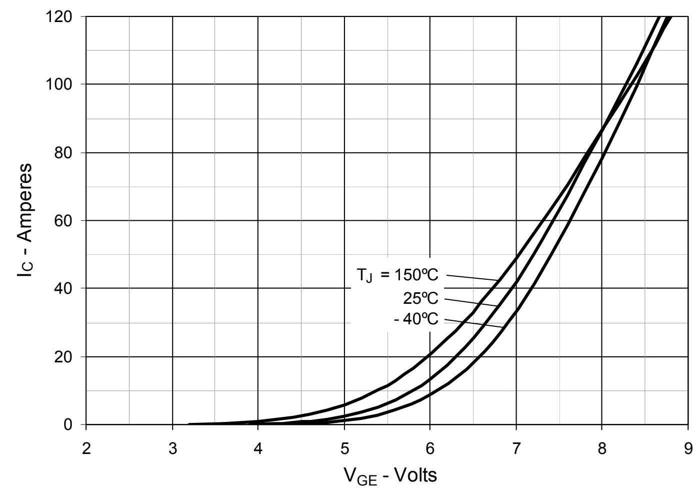

### Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature




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




### Fig. 6. Input Admittance



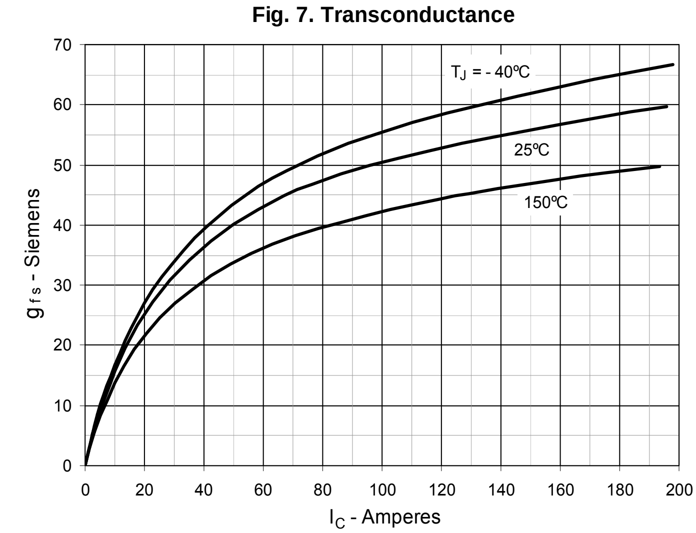


Fig. 7. Transconductance
TJ = - 40ºC
25ºC
150ºC
g f s - Siemens
IC - Amperes
0
10
20
30
40
50
60
70
0
20
40
60
80
100
120
140
160
180
200

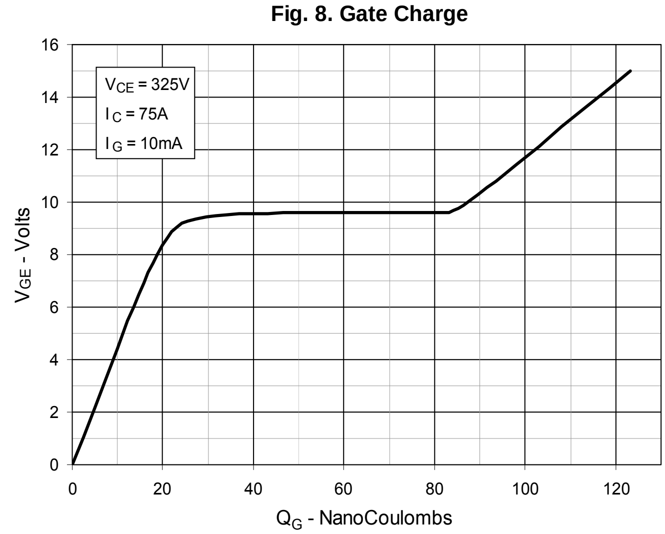


Fig. 8. Gate Charge
VCE = 325V
I C = 75A
I G = 10mA
VGE - Volts
QG - NanoCoulombs
0
2
4
6
8
10
12
14
16
0
20
40
60
80
100
120

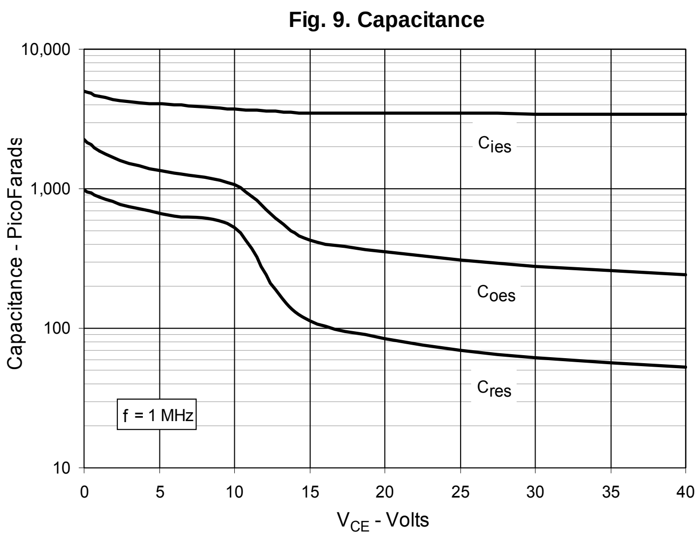


Fig. 9. Capacitance
Cies
Coes
Cres
f = 1 MHz
Capacitance - PicoFarads
VCE - Volts
10
100
1,000
10,000
0
5
10
15
20
25
30
35
40

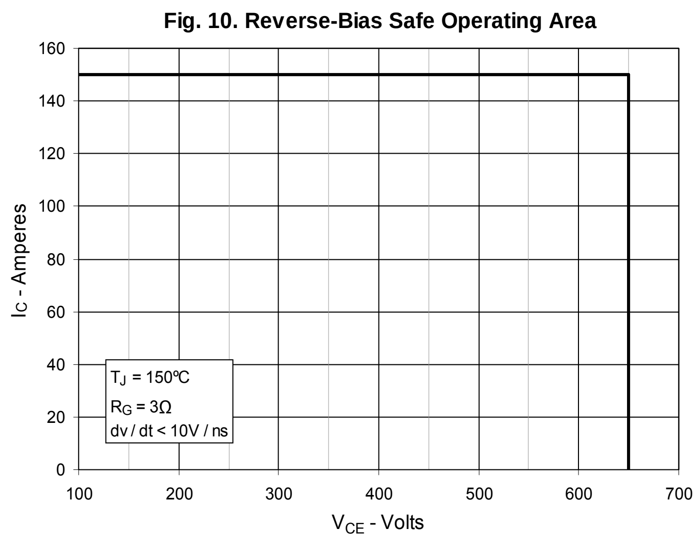


Fig. 10. Reverse-Bias Safe Operating Area
TJ = 150ºC
RG = 3Ω
dv / dt < 10V / ns
IC - Amperes
VCE - Volts
0
20
40
60
80
100
120
140
160
100
200
300
400
500
600
700

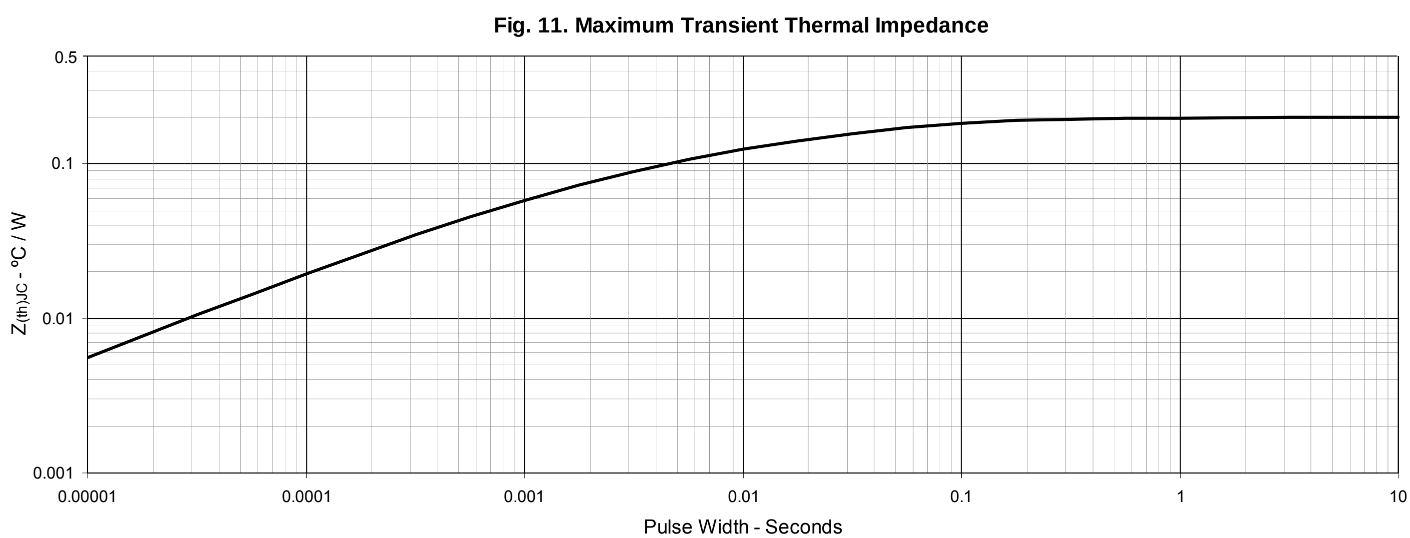


Fig. 11. Maximum Transient Thermal Impedance
Z(th)JC - ºC / W
Pulse Width - Seconds
0.001
0.01
0.1
0.5
0.00001
0.0001
0.001
0.01
0.1
1
10

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

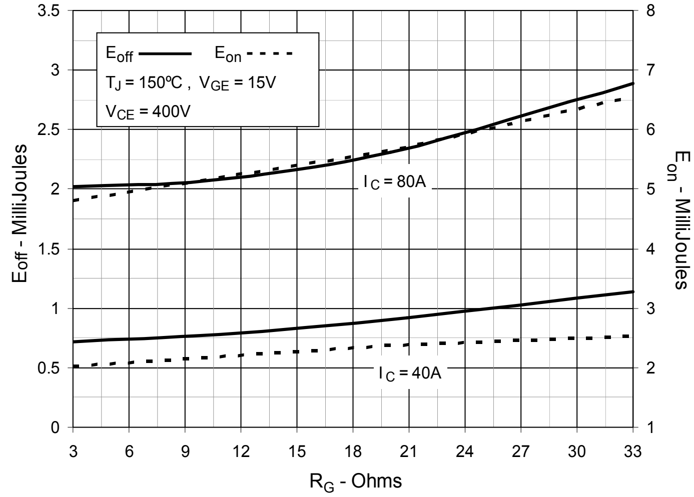



**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**

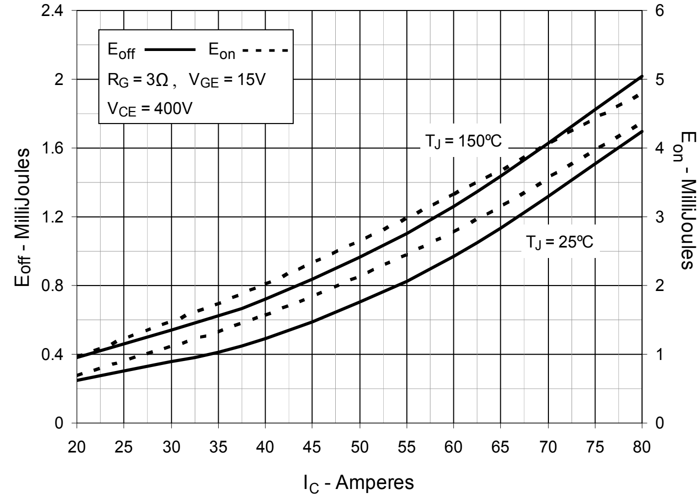



**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**

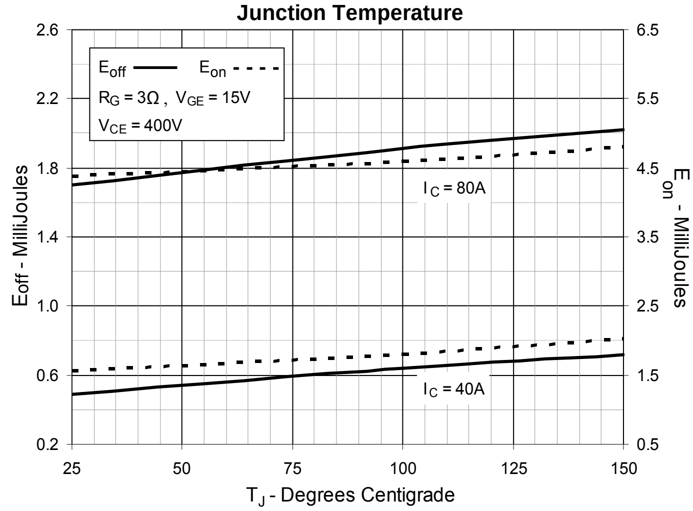



**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**

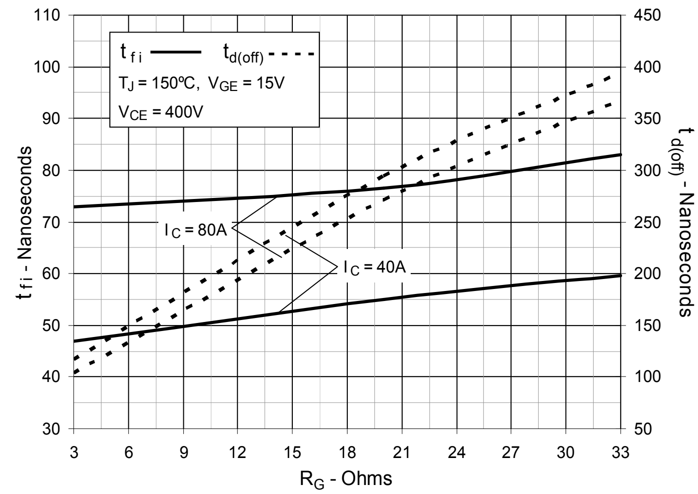



**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**

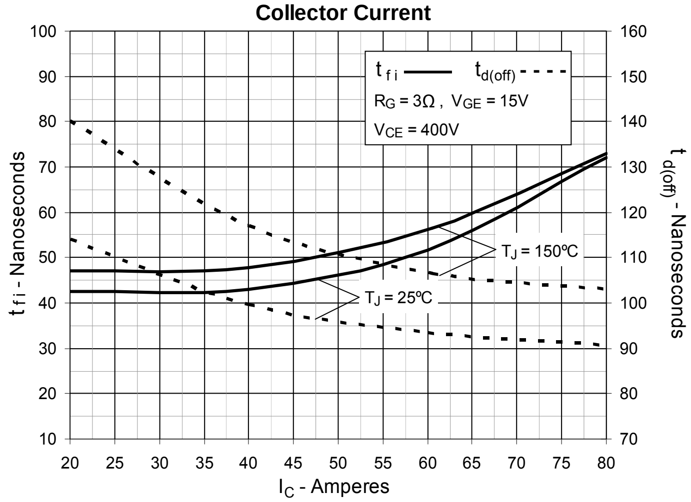



**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**

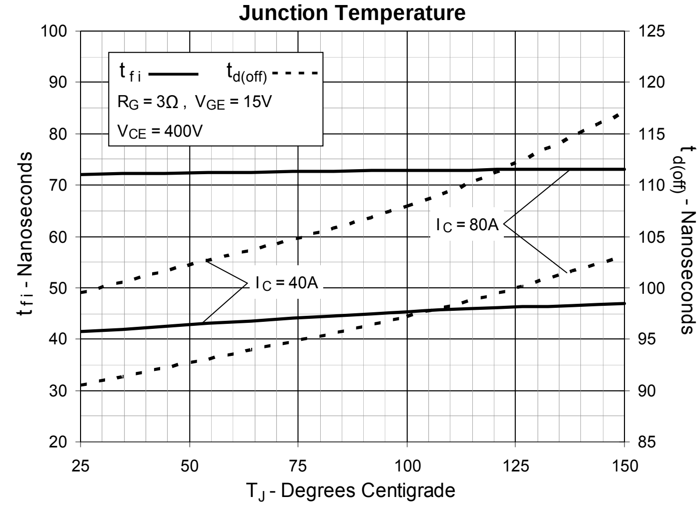


**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**

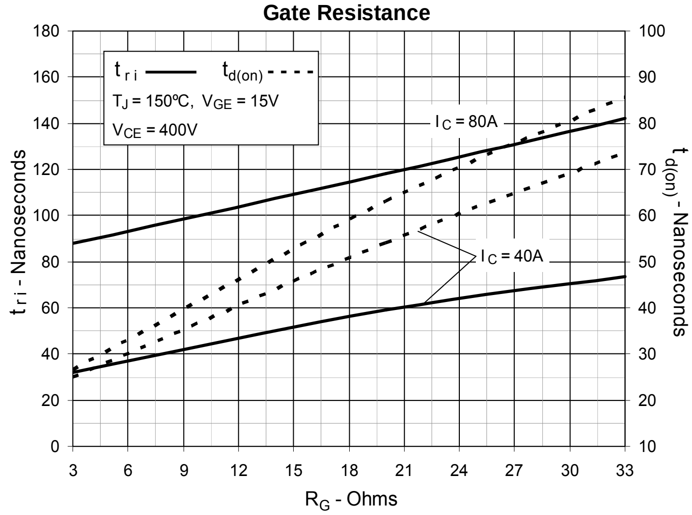



**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**

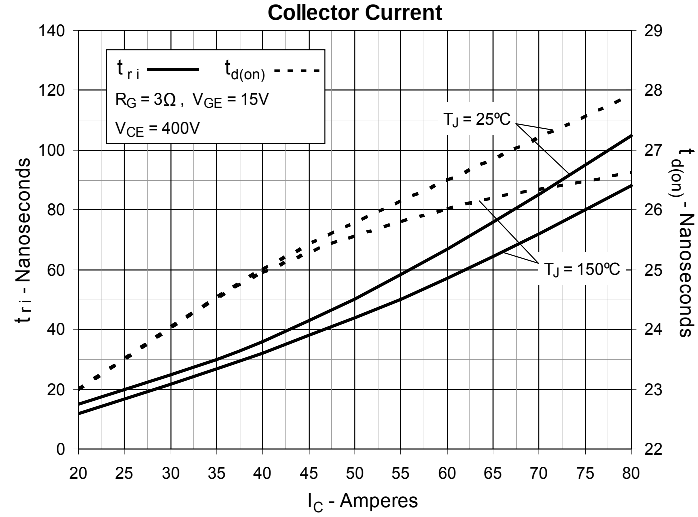



**Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature**

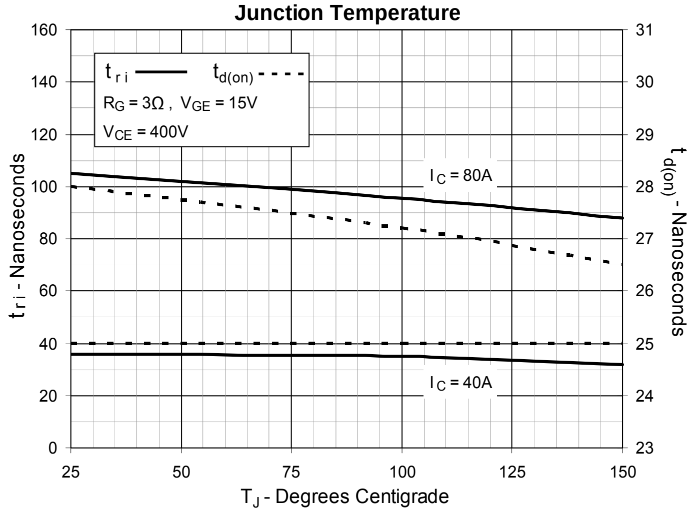



**Fig. 21. Maximum Peak Load Current vs. Frequency**

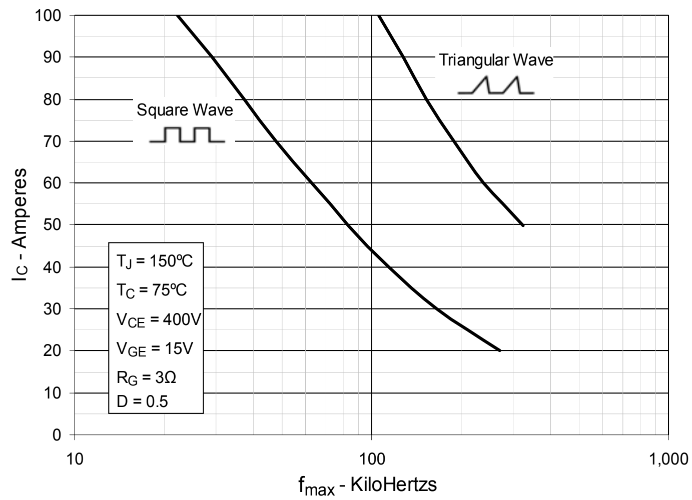


**Fig. 22. Typ. Forward characteristics**

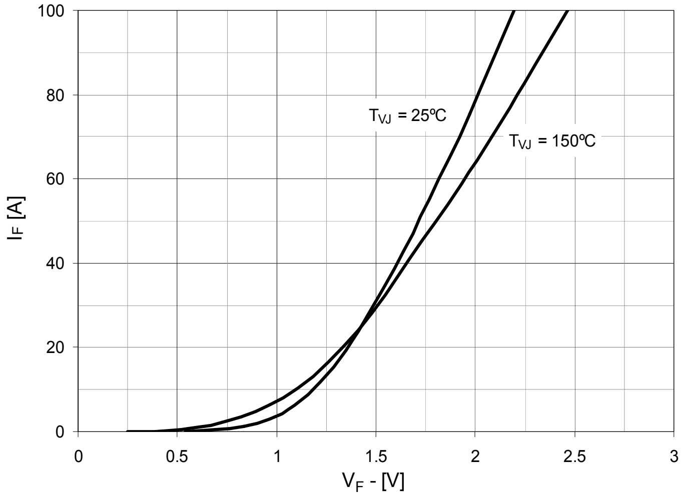



**Fig. 23. Typ. Reverse Recovery Charge $Q_{rr}$ vs. $-di_F/dt$**

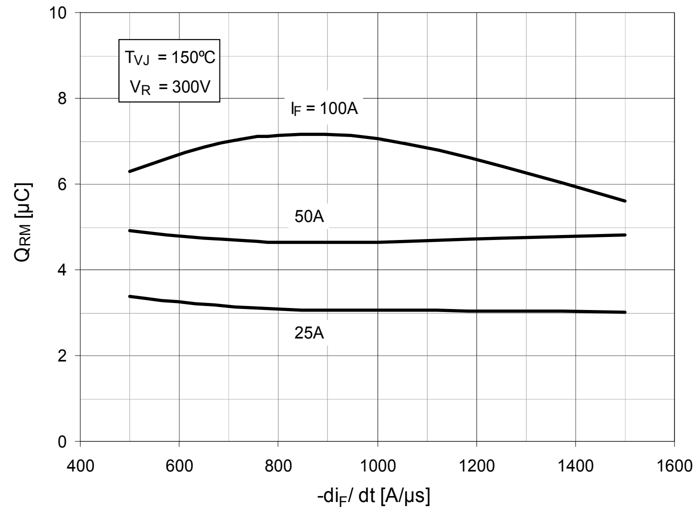



**Fig. 24. Typ. Peak Reverse Current $I_{RM}$ vs. $-di_F/dt$**

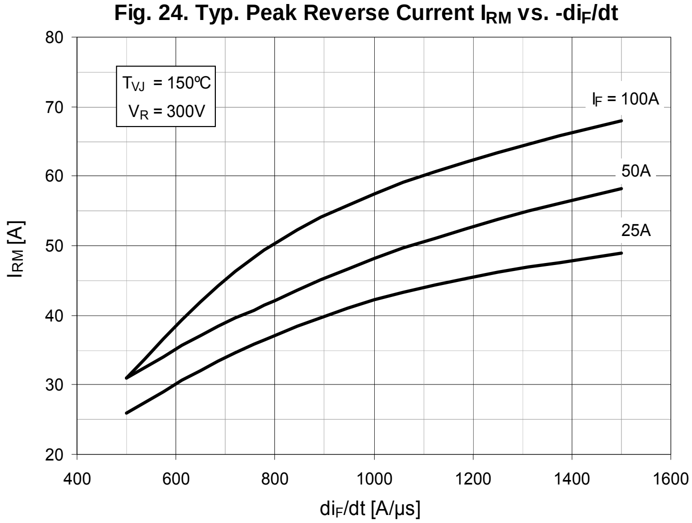



**Fig. 25. Typ. Recovery Time $t_{rr}$ vs. $-di_F/dt$**

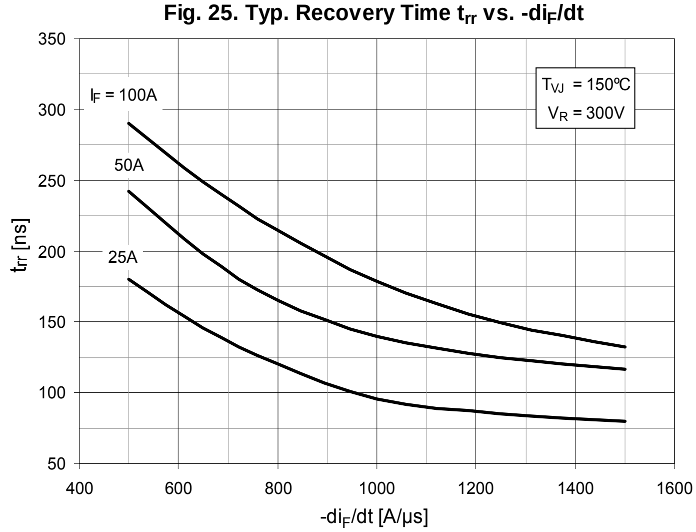



**Fig. 26. Typ. Recovery Energy $E_{rec}$ vs. $-di_F/dt$**

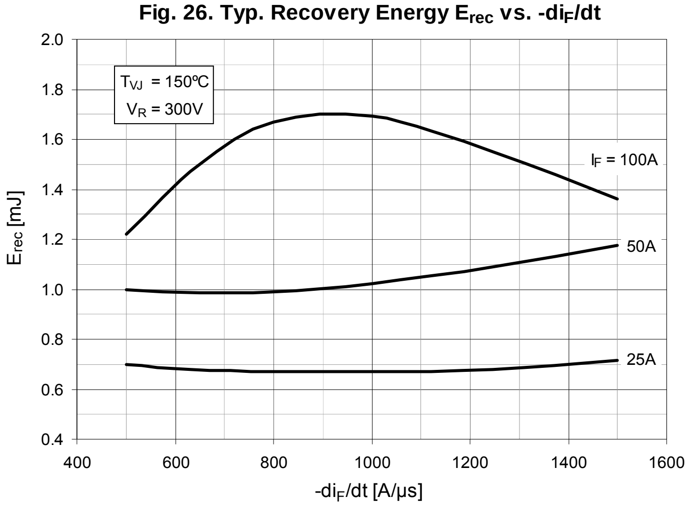



**Fig. 27. Maximum Transient Thermal Impedance**