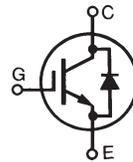


# GenX3™ 600V IGBT with Diode

## IXGX72N60C3H1

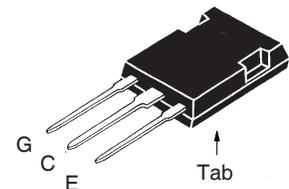
High-Speed PT IGBT for 40-100kHz Switching



$V_{CES} = 600V$   
 $I_{C110} = 72A$   
 $V_{CE(sat)} \leq 2.5V$   
 $t_{fi(typ)} = 55ns$

| Symbol                        | Test Conditions   | Maximum Ratings                         |            |
|-------------------------------|---|---|------------|
| $V_{CES}$                     | $T_J = 25^\circ C$ to $150^\circ C$   | 600                                     | V          |
| $V_{CGR}$                     | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GE} = 1M\Omega$                           | 600                                     | V          |
| $V_{GES}$                     | Continuous  | $\pm 20$                                | V          |
| $V_{GEM}$                     | Transient   | $\pm 30$                                | V          |
| $I_{C25}$                     | $T_C = 25^\circ C$ (Limited by Leads)   | 75                                      | A          |
| $I_{C110}$                    | $T_C = 110^\circ C$ (Chip Capability)   | 72                                      | A          |
| $I_{CM}$                      | $T_C = 25^\circ C$ , 1ms  | 360                                     | A          |
| $I_A$                         | $T_C = 25^\circ C$  | 50                                      | A          |
| $E_{AS}$                      | $T_C = 25^\circ C$  | 500                                     | mJ         |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 2\Omega$<br>Clamped Inductive Load | $I_{CM} = 150$<br>$V_{CE} \leq V_{CES}$ | A          |
| $P_C$                         | $T_C = 25^\circ C$  | 540                                     | W          |
| $T_J$                         |   | -55 ... +150                            | $^\circ C$ |
| $T_{JM}$                      |   | 150                                     | $^\circ C$ |
| $T_{stg}$                     |   | -55 ... +150                            | $^\circ C$ |
| $M_F$                         | Mounting Force  | 20..120 / 4.5..27                       | N/lb.      |
| $T_L$                         | Maximum Lead Temperature for Soldering  | 300                                     | $^\circ C$ |
| $T_{SOLD}$                    | 1.6mm (0.062 in.) from Case for 10s   | 260                                     | $^\circ C$ |
| <b>Weight</b>                 | PLUS247   | 6                                       | g          |

### PLUS247



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

### Features

- Optimized for Low Switching Losses
- Square RBSOA
- Avalanche Rated
- Anti-Parallel Ultra Fast Diode
- International Standard Package

### Advantages

- High Power Density
- Low Gate Drive Requirement

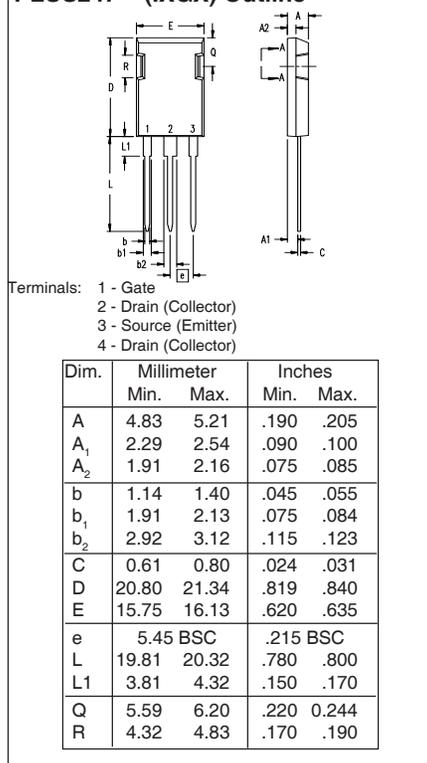
### Applications

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

| Symbol        | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |                     |
|---------------|---|-----------------------|------|---------------------|
|               |   | Min.                  | Typ. | Max.                |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                                  | 3.0                   |      | 5.5 V               |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 125^\circ C$             |                       |      | 250 $\mu A$<br>3 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |      | $\pm 100$ nA        |
| $V_{CE(sat)}$ | $I_C = 50A$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 125^\circ C$          | 2.10<br>1.65          |      | 2.50 V              |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)   | Characteristic Values |      |                    |
|--------------|---|-----------------------|------|--------------------|
|              |   | Min.                  | Typ. | Max.               |
| $g_{fs}$     | $I_C = 50\text{A}$ , $V_{CE} = 10\text{V}$ , Note 1   | 33                    | 55   | S                  |
| $C_{ies}$    | $V_{CE} = 25\text{V}$ , $V_{GE} = 0\text{V}$ , $f = 1\text{MHz}$  |                       | 4780 | pF                 |
| $C_{oes}$    |   |                       | 330  | pF                 |
| $C_{res}$    |   |                       | 117  | pF                 |
| $Q_g$        | $I_C = 50\text{A}$ , $V_{GE} = 15\text{V}$ , $V_{CE} = 0.5 \cdot V_{CES}$   |                       | 174  | nC                 |
| $Q_{ge}$     |   |                       | 33   | nC                 |
| $Q_{gc}$     |   |                       | 72   | nC                 |
| $t_{d(on)}$  | <b>Inductive Load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 50\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 480\text{V}$ , $R_G = 2\Omega$ , Note 2 |                       | 27   | ns                 |
| $t_{ri}$     |   |                       | 37   | ns                 |
| $E_{on}$     |   |                       | 1.03 | mJ                 |
| $t_{d(off)}$ |   |                       | 77   | 130 ns             |
| $t_{fi}$     |   |                       | 55   | 110 ns             |
| $E_{off}$    |   |                       | 0.48 | 0.95 mJ            |
| $t_{d(on)}$  | <b>Inductive Load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 50\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 480\text{V}$ , $R_G = 2\Omega$ , Note 2 |                       | 26   | ns                 |
| $t_{ri}$     |   |                       | 36   | ns                 |
| $E_{on}$     |   |                       | 1.48 | mJ                 |
| $t_{d(off)}$ |   |                       | 120  | ns                 |
| $t_{fi}$     |   |                       | 124  | ns                 |
| $E_{off}$    |   |                       | 0.93 | mJ                 |
| $R_{thJC}$   |   |                       | 0.23 | $^\circ\text{C/W}$ |
| $R_{thCS}$   |   | 0.15                  |      | $^\circ\text{C/W}$ |

### PLUS247™ (IXGX) Outline



### Reverse Diode (FRED)

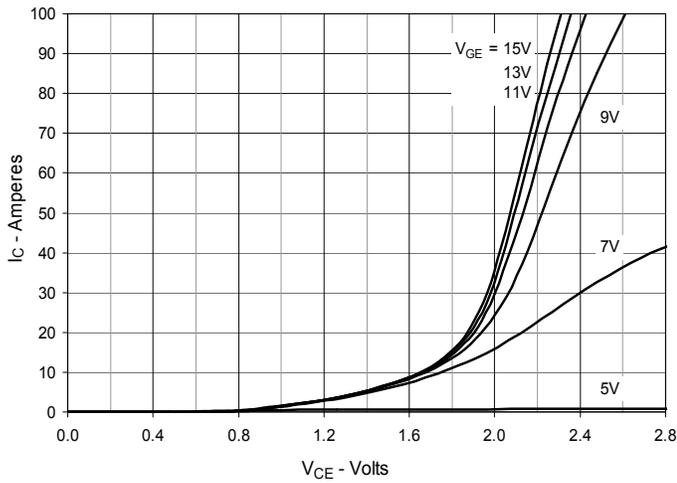
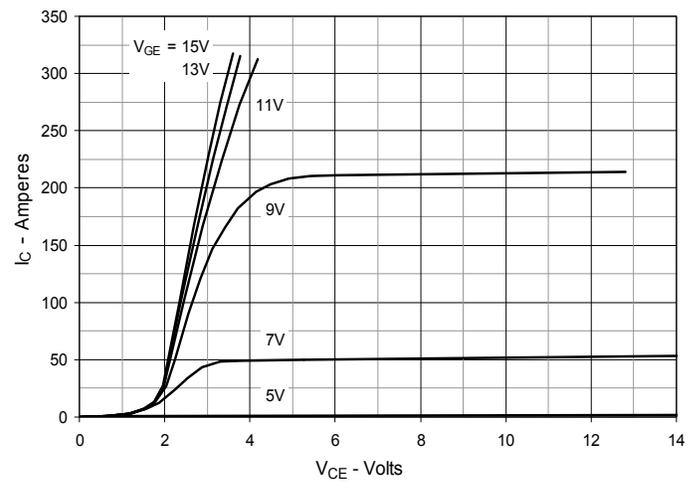
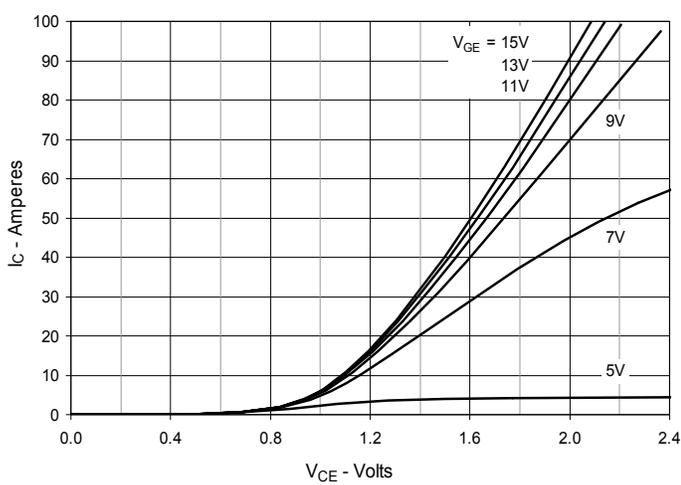
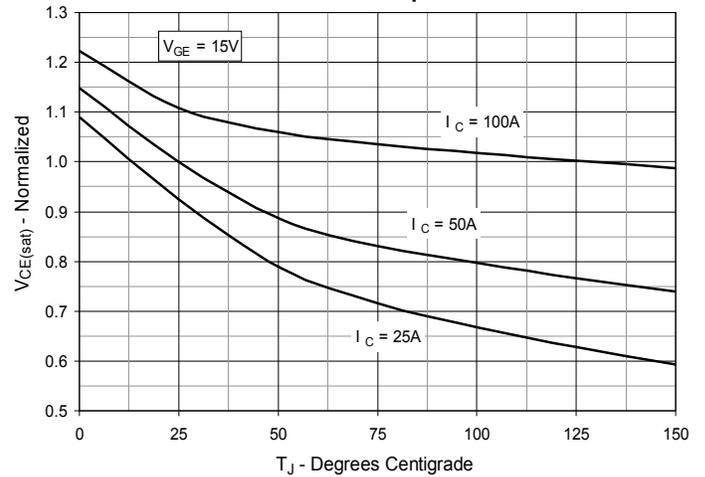
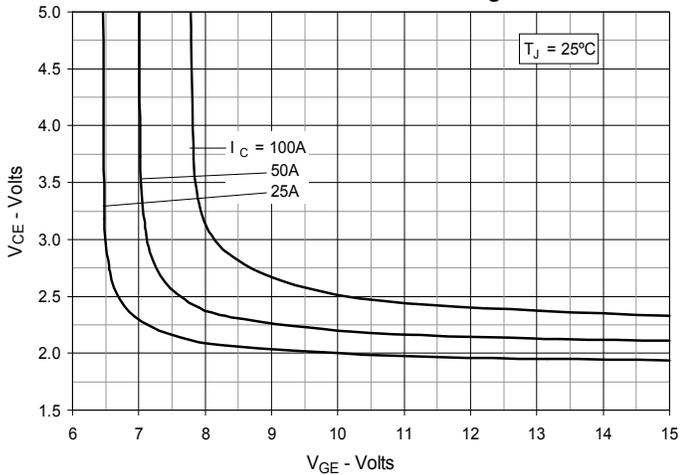
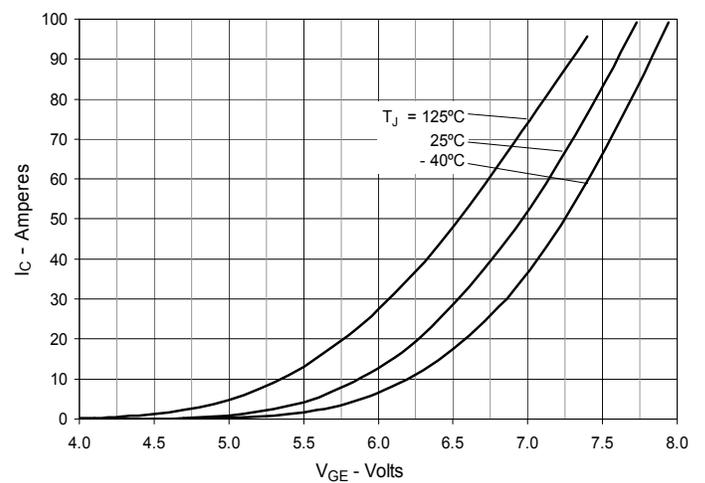
| Symbol     | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)  | Characteristic Values |            |                        |
|------------|--|-----------------------|------------|------------------------|
|            |  | Min.                  | Typ.       | Max.                   |
| $V_F$      | $I_F = 60\text{A}$ , $V_{GE} = 0\text{V}$ , Note 1<br>$T_J = 150^\circ\text{C}$  |                       | 1.6<br>1.4 | 2.0 V<br>1.8 V         |
| $I_{RM}$   | $I_F = 60\text{A}$ , $V_{GE} = 0\text{V}$ ,<br>$-di_F/dt = 200\text{A}/\mu\text{s}$ , $V_R = 300\text{V}$<br>$T_J = 100^\circ\text{C}$ |                       | 8.3        | A                      |
| $t_{rr}$   |  |                       | 140        | ns                     |
| $R_{thJC}$ |  |                       |            | 0.3 $^\circ\text{C/W}$ |

### Notes:

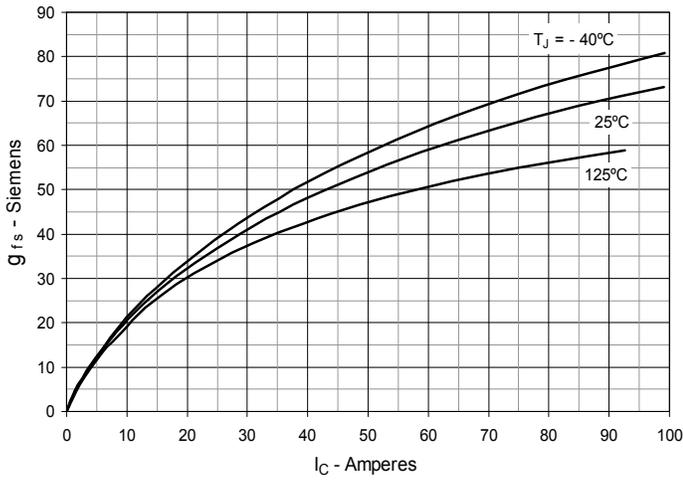
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (Clamp),  $T_J$  or  $R_G$ .

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

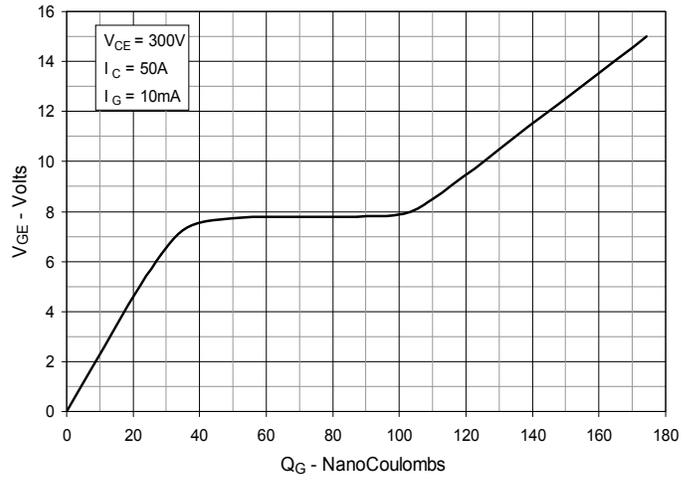
|  |           |           |           |           |              |              |              |              |              |             |
|--|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| IXYS MOSFETs and 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 @  $T_J = 25^\circ\text{C}$** 

**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$** 

**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**


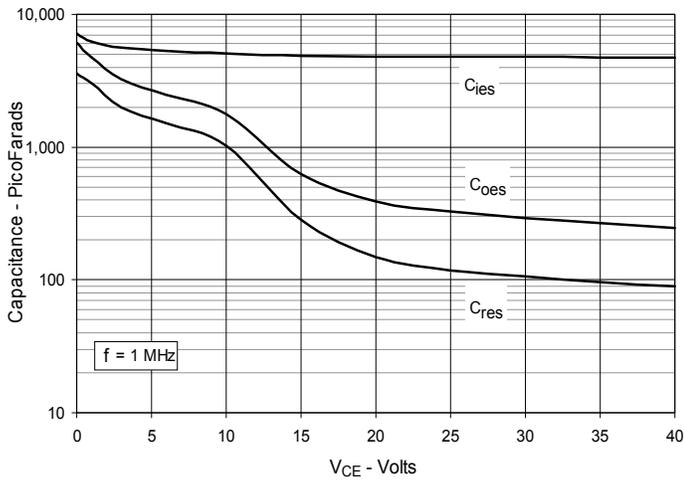
**Fig. 7. Transconductance**



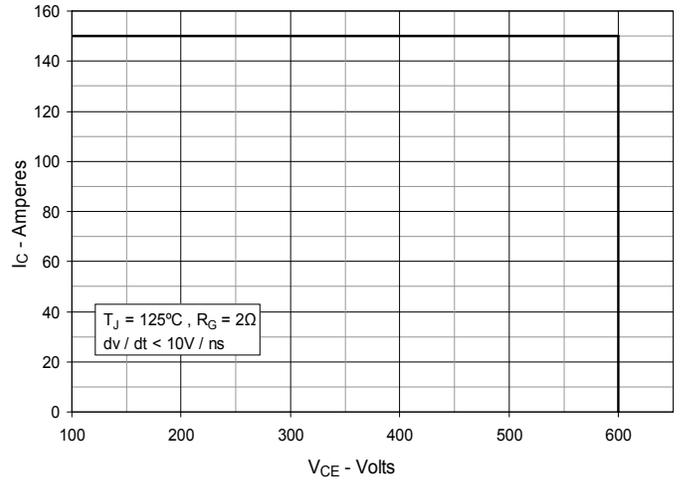
**Fig. 8. Gate Charge**



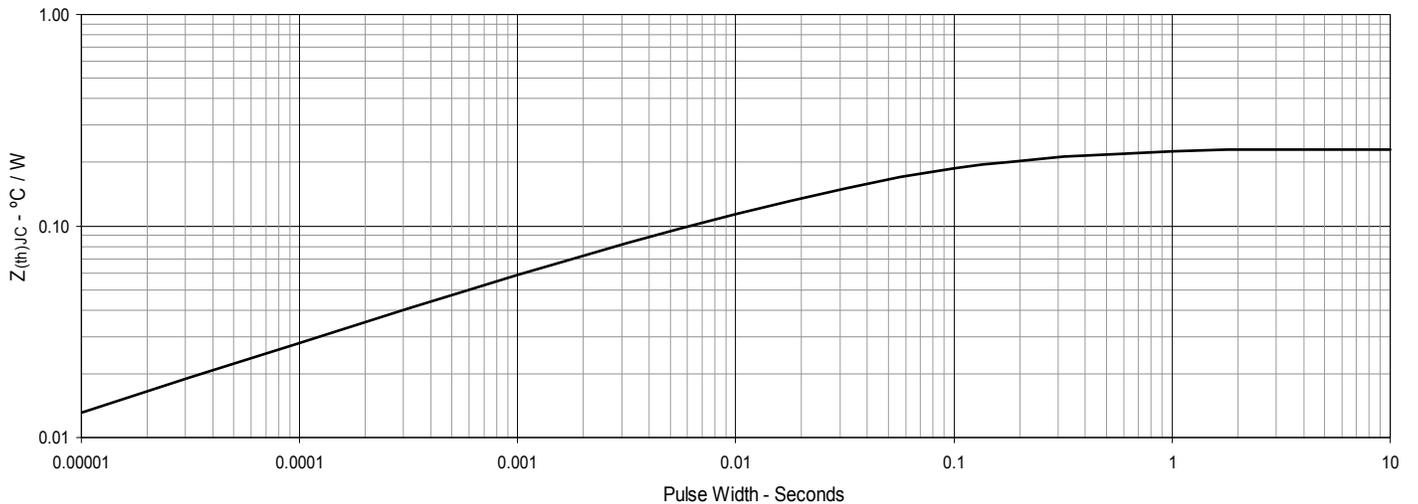
**Fig. 9. Capacitance**



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

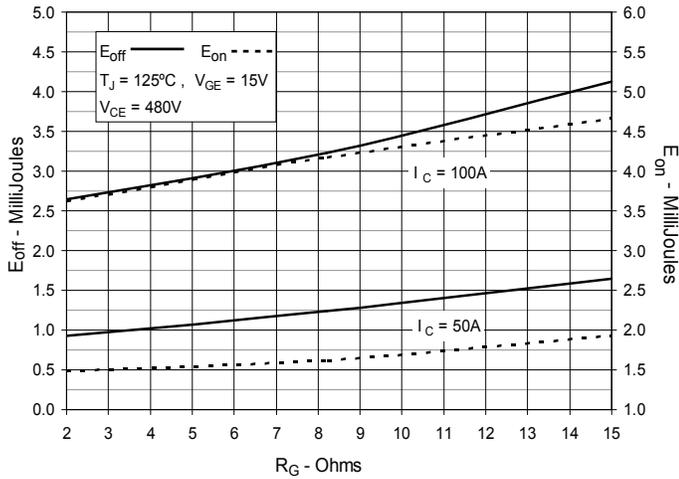


**Fig. 11. Maximum Transient Thermal Impedance**

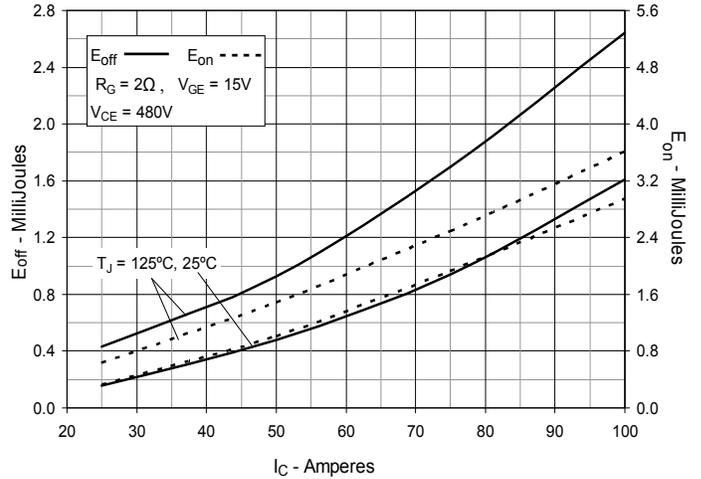


IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

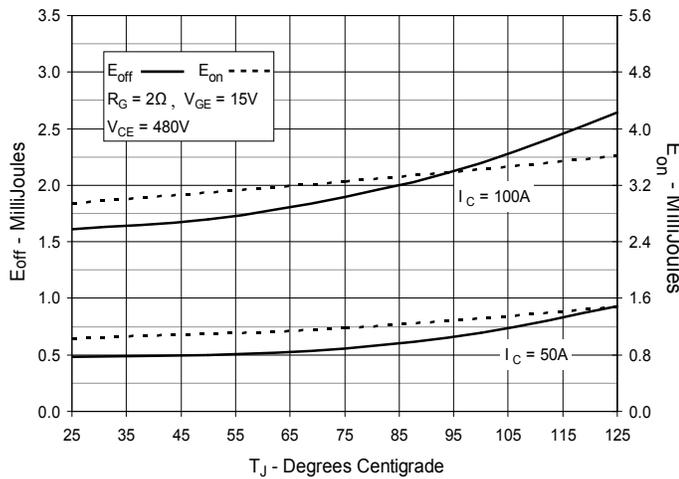
**Fig. 12. Inductive Switching  
Energy Loss vs. Gate Resistance**



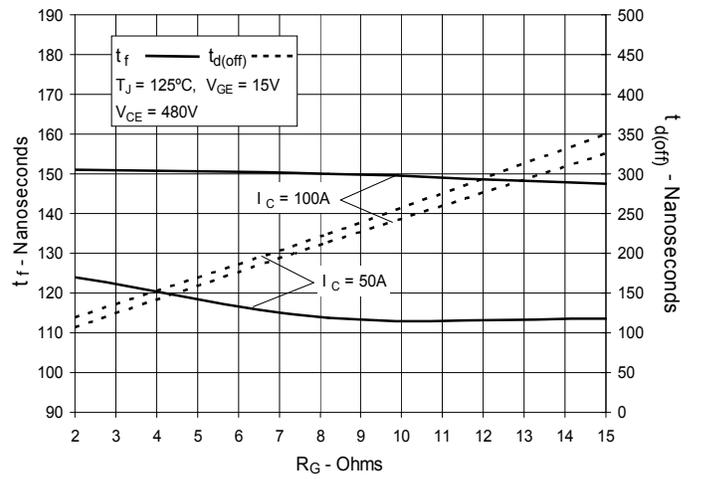
**Fig. 13. Inductive Switching  
Energy Loss vs. Collector Current**



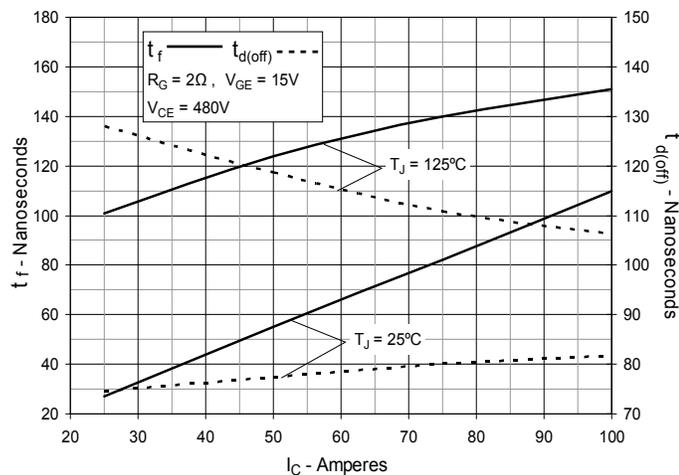
**Fig. 14. Inductive Switching  
Energy Loss vs. Junction Temperature**



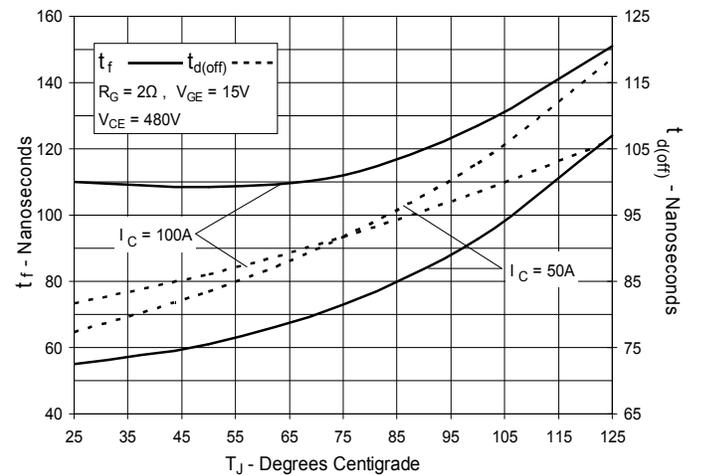
**Fig. 15. Inductive Turn-off  
Switching Times vs. Gate Resistance**



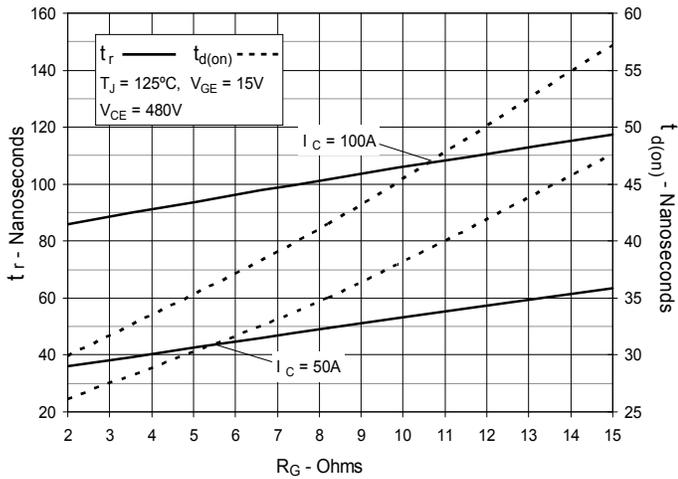
**Fig. 16. Inductive Turn-off  
Switching Times vs. Collector Current**



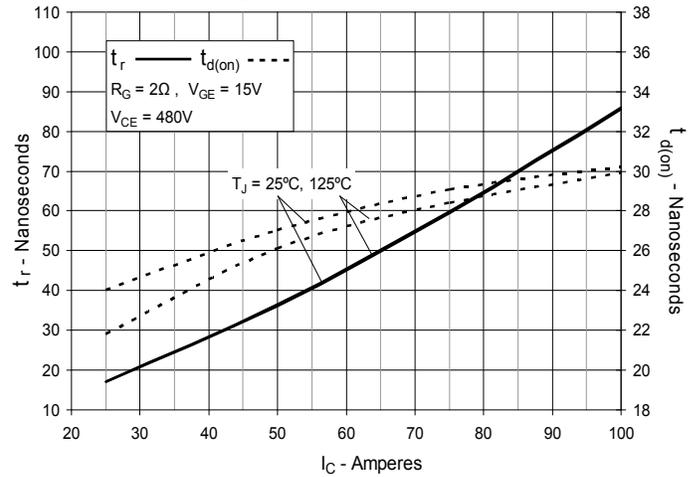
**Fig. 17. Inductive Turn-off  
Switching Times vs. Junction Temperature**



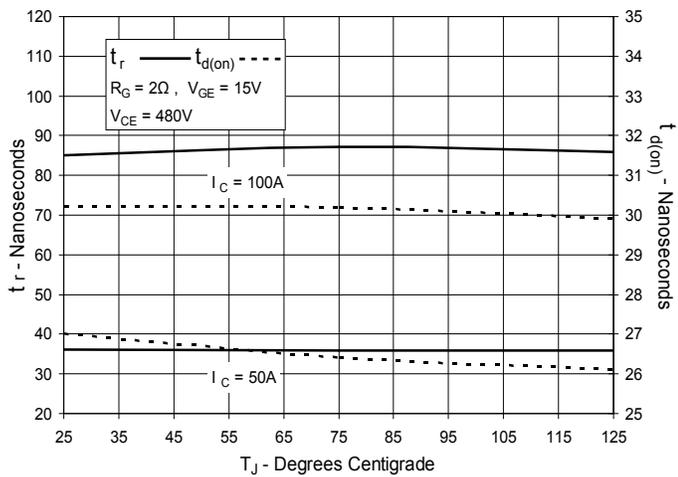
**Fig. 18. Inductive Turn-on  
Switching Times vs. Gate Resistance**



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



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



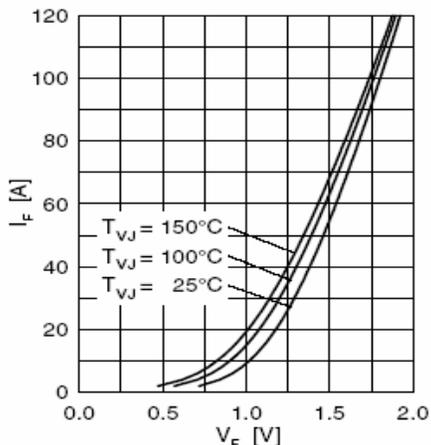


Fig. 1 Forward current  $I_F$  vs.  $V_F$

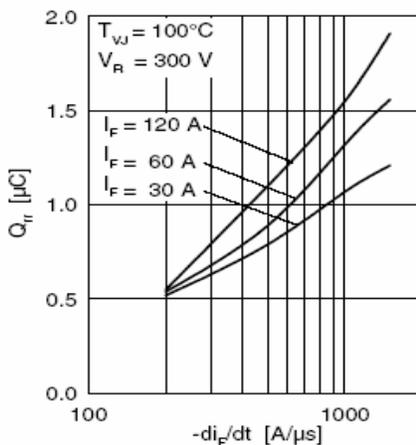


Fig. 2 Typ. reverse recovery charge  $Q_{rr}$

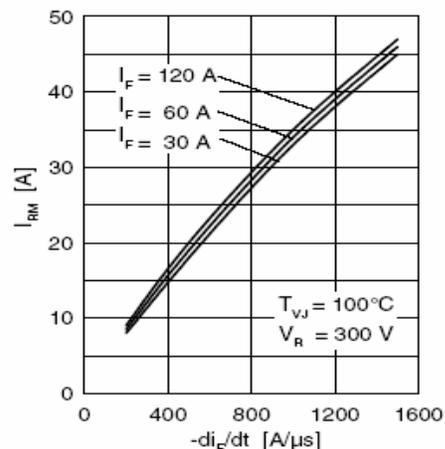


Fig. 3 Typ. peak reverse current  $I_{RM}$

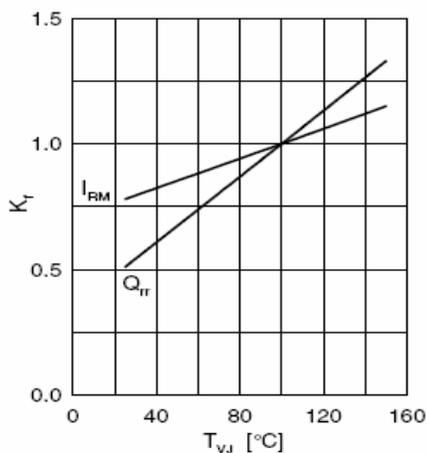


Fig. 4 Typ. dynamic parameters  $Q_{rr}$ ,  $I_{RM}$

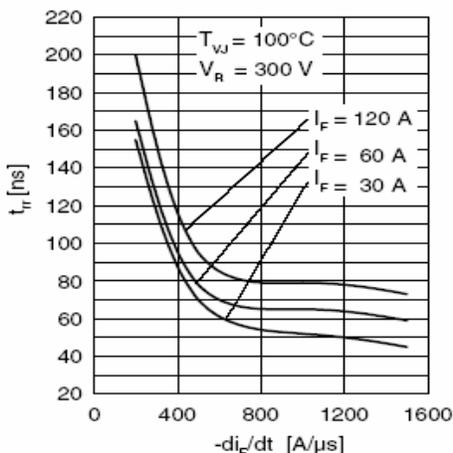


Fig. 5 Typ. recovery time  $t_{rr}$

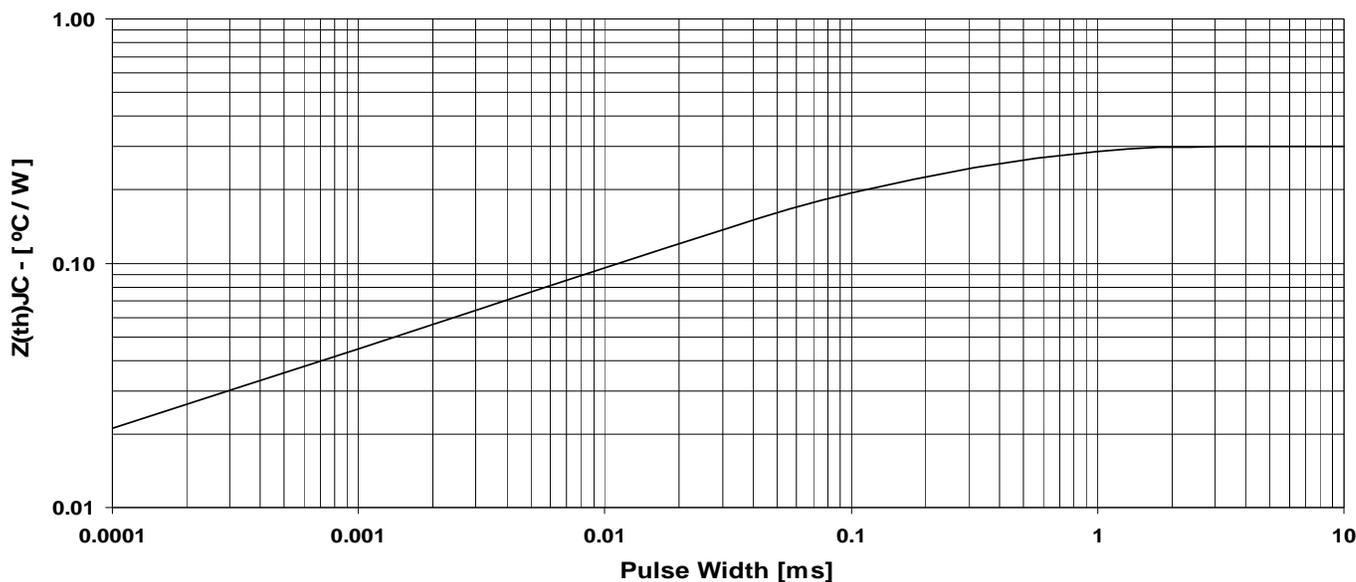


Fig. 26 Maximum transient thermal impedance junction to case (for diode)