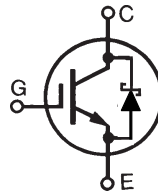


# HiperFAST™ IGBT w/ SiC Anti-Parallel Diode

## IXGR60N60C2C1

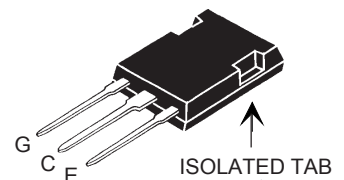


(Electrically Isolated Back Surface)

$V_{CES}$  = 600V  
 $I_{C110}$  = 39A  
 $V_{CE(sat)}$  ≤ 2.7V  
 $t_{fi(typ)}$  = 54ns

| Symbol                        | Test Conditions  | Maximum Ratings                       |                  |
|-------------------------------|--|---------------------------------------|------------------|
| $V_{CES}$                     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$  | 600                                   | V                |
| $V_{CGR}$                     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GE} = 1\text{M}\Omega$                     | 600                                   | V                |
| $V_{GES}$                     | Continuous   | ±20                                   | V                |
| $V_{GEM}$                     | Transient  | ±30                                   | V                |
| $I_{C25}$                     | $T_C = 25^\circ\text{C}$ (Limited by Leads)  | 75                                    | A                |
| $I_{C110}$                    | $T_C = 110^\circ\text{C}$  | 39                                    | A                |
| $I_{F110}$                    | $T_C = 110^\circ\text{C}$  | 14                                    | A                |
| $I_{CM}$                      | $T_C = 25^\circ\text{C}$ , 1ms   | 300                                   | A                |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15\text{V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 2\Omega$<br>Clamped Inductive Load | $I_{CM} = 100$<br>@ $V_{CE} \leq 600$ | A<br>V           |
| $P_C$                         | $T_C = 25^\circ\text{C}$   | 250                                   | W                |
| $T_J$                         |  | -55 ... +150                          | $^\circ\text{C}$ |
| $T_{JM}$                      |  | 150                                   | $^\circ\text{C}$ |
| $T_{stg}$                     |  | -55 ... +150                          | $^\circ\text{C}$ |
| $V_{ISOL}$                    | 50/60 Hz, RMS, $t = 1\text{minute}$<br>$I_{ISOL} < 1\text{mA}$ $t = 10\text{ s}$                 | 2500<br>3000                          | V~<br>V~         |
| $F_C$                         | Mounting Force   | 20..120/4.5..27                       | N/lb             |
| $T_L$                         | Maximum Lead Temperature for Soldering   | 300                                   | $^\circ\text{C}$ |
| $T_{SOLD}$                    | 1.6mm (0.062 in.) from Case for 10s  | 260                                   | $^\circ\text{C}$ |
| <b>Weight</b>                 |  | 5                                     | g                |

### ISOPLUS 247™



G = Gate      C = Collector  
 E = Emitter

### Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface
- High Speed Silicon Carbide Schottky Co-Pack Diode
  - No Reverse Recovery
- 2500V Electrical Isolation

### Advantages

- High Power Density
- Low Gate Drive Requirement

### Applications

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

| Symbol        | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)      | Characteristic Values |              |                           |
|---------------|--|-----------------------|--------------|---------------------------|
|               |  | Min.                  | Typ.         | Max.                      |
| $V_{GE(th)}$  | $I_C = 250\mu\text{A}$ , $V_{CE} = V_{GE}$                                       | 2.5                   |              | 5.0 V                     |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0\text{V}$<br>$T_J = 125^\circ\text{C}$           |                       |              | 250 $\mu\text{A}$<br>2 mA |
| $I_{GES}$     | $V_{CE} = 0\text{V}$ , $V_{GE} = \pm 20\text{V}$                                 |                       |              | ±100 nA                   |
| $V_{CE(sat)}$ | $I_C = 50\text{A}$ , $V_{GE} = 15\text{V}$ , Note 1<br>$T_J = 125^\circ\text{C}$ |                       | 2.17<br>1.83 | V<br>V                    |

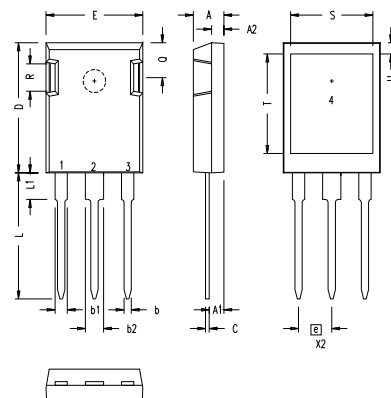
| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)   | Characteristic Values |   |         |
|--|---|-----------------------|---|---------|
|  |   | Min.                  | Typ.  | Max.    |
| $g_{fs}$   | $I_C = 50\text{A}$ , $V_{CE} = 10\text{V}$ , Note 1   | 30                    | 47  | S       |
| $C_{ies}$<br>$C_{oes}$<br>$C_{res}$  | $V_{CE} = 25\text{V}$ , $V_{GE} = 0\text{V}$ , $f = 1\text{MHz}$  |                       | 4750  | pF      |
|  |   |                       | 530   | pF      |
|  |   |                       | 66  | pF      |
| $Q_g$<br>$Q_{ge}$<br>$Q_{gc}$  | $I_C = 50\text{A}$ , $V_{GE} = 15\text{V}$ , $V_{CE} = 0.5 \cdot V_{CES}$   |                       | 143   | nC      |
|  |   |                       | 27  | nC      |
|  |   |                       | 48  | nC      |
| $t_{d(on)}$<br>$t_{ri}$<br>$E_{on}$<br>$t_{d(off)}$<br>$t_{fi}$<br>$E_{off}$ | Inductive Load, $T_J = 25^\circ\text{C}$<br>$I_C = 50\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}$ , $R_G = 2\Omega$  |                       | 27  | ns      |
|  |   |                       | 52  | ns      |
|  |   |                       | 0.88  | mJ      |
|  |   |                       | 92  | 150 ns  |
|  |   |                       | 54  | ns      |
|  |   |                       | 0.48  | 0.80 mJ |
| $t_{d(on)}$<br>$t_{ri}$<br>$E_{on}$<br>$t_{d(off)}$<br>$t_{fi}$<br>$E_{off}$ | Inductive Load, $T_J = 125^\circ\text{C}$<br>$I_C = 50\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}$ , $R_G = 2\Omega$ |                       | 27  | ns      |
|  |   |                       | 50  | ns      |
|  |   |                       | 0.90  | mJ      |
|  |   |                       | 104   | ns      |
|  |   |                       | 157   | ns      |
|  |   |                       | 1.20  | mJ      |
| $R_{thJC}$<br>$R_{thCS}$   |   | 0.15                  | 0.50 $^\circ\text{C/W}$<br>$^\circ\text{C/W}$ |         |

### Reverse Diode (SiC)

| Symbol     | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)     | Characteristic Values |              |                         |
|------------|---|-----------------------|--------------|-------------------------|
|            |   | Min.                  | Typ.         | Max.                    |
| $V_F$      | $I_F = 20\text{A}$ , $V_{GE} = 0\text{V}$ , Note 1<br>$T_J = 125^\circ\text{C}$ |                       | 1.65<br>2.00 | V<br>V                  |
| $R_{thJC}$ |   |                       |              | 1.75 $^\circ\text{C/W}$ |

Note 1. Pulse Test,  $t \leq 300\mu\text{s}$ ; Duty Cycle,  $d \leq 2\%$ .

### ISOPLUS247 (IXGR) Outline



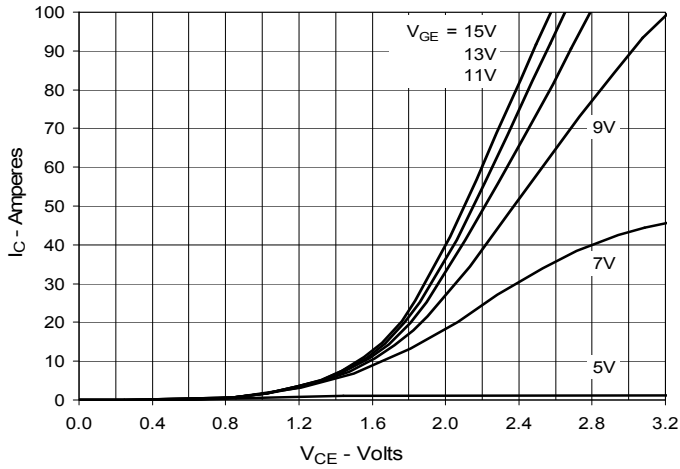
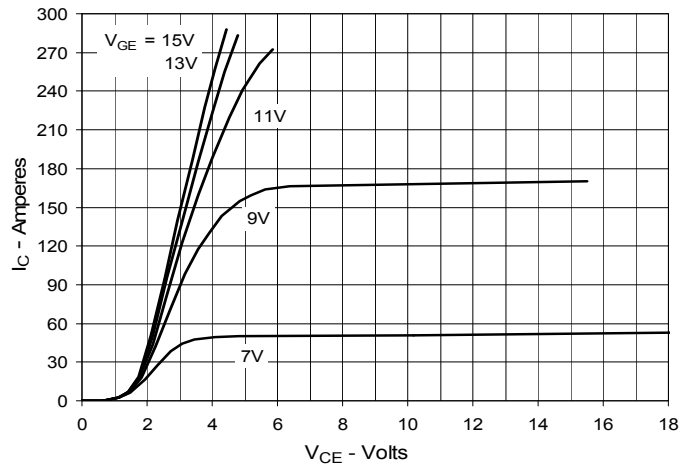
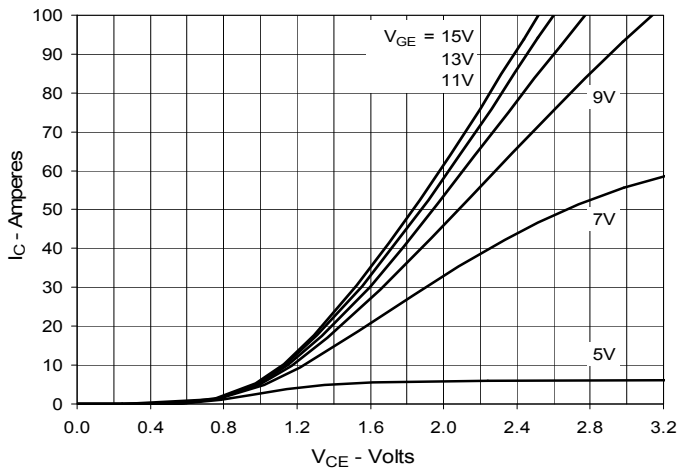
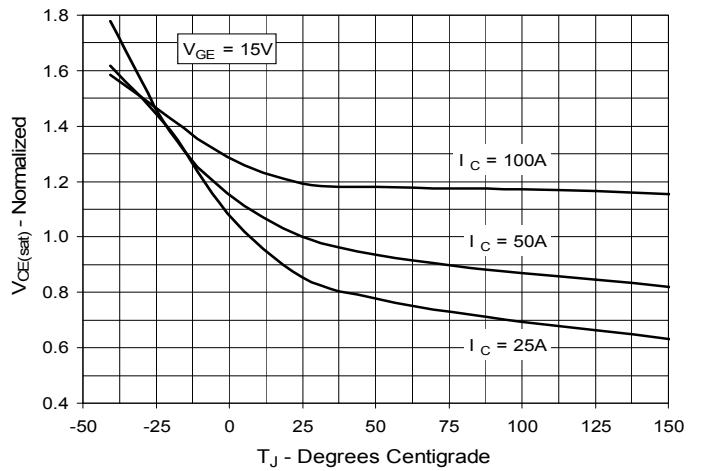
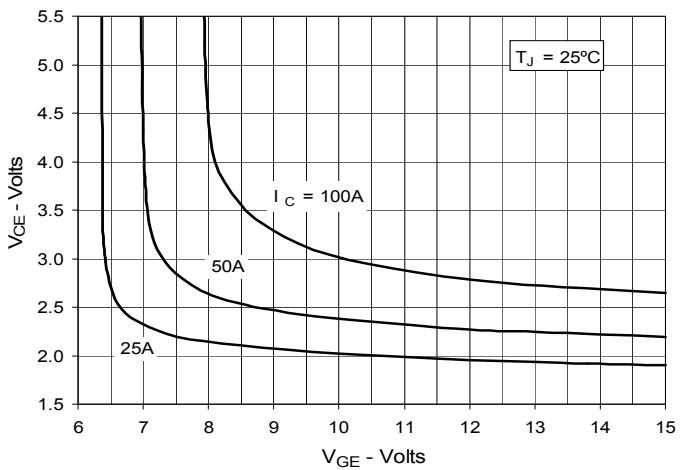
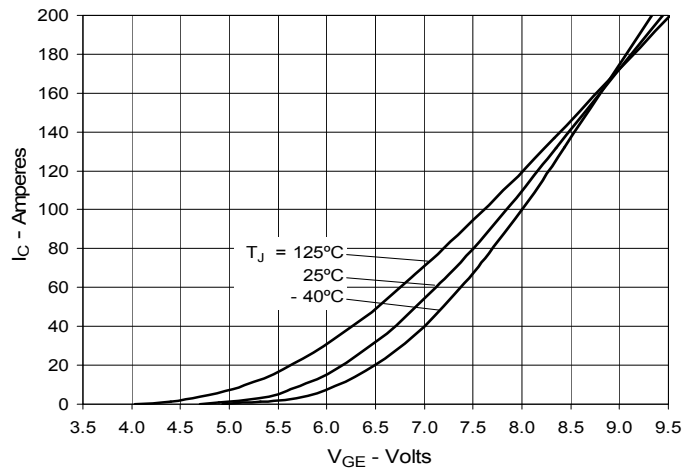
| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .190     | .205 | 4.83        | 5.21  |
| A1  | .090     | .100 | 2.29        | 2.54  |
| A2  | .075     | .085 | 1.91        | 2.16  |
| b   | .045     | .055 | 1.14        | 1.40  |
| b1  | .075     | .084 | 1.91        | 2.13  |
| b2  | .115     | .123 | 2.92        | 3.12  |
| C   | .024     | .031 | 0.61        | 0.80  |
| D   | .819     | .840 | 20.80       | 21.34 |
| E   | .620     | .635 | 15.75       | 16.13 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .780     | .800 | 19.81       | 20.32 |
| L1  | .150     | .170 | 3.81        | 4.32  |
| Q   | .220     | .244 | 5.59        | 6.20  |
| R   | .170     | .190 | 4.32        | 4.83  |
| S   | .520     | .540 | 13.21       | 13.72 |
| T   | .620     | .640 | 15.75       | 16.26 |
| U   | .065     | .080 | 1.65        | 2.03  |

- 1 - GATE
- 2 - DRAIN (COLLECTOR)
- 3 - SOURCE (EMITTER)
- 4 - NO CONNECTION

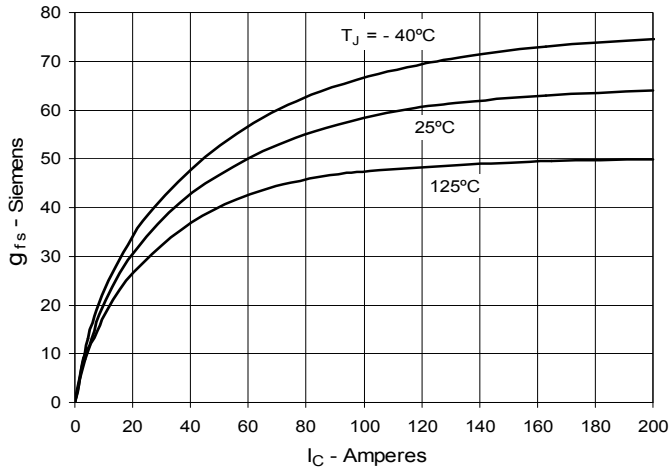
NOTE: This drawing will meet all dimensions requirement of JEDEC outline TO-247AD except screw hole.

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

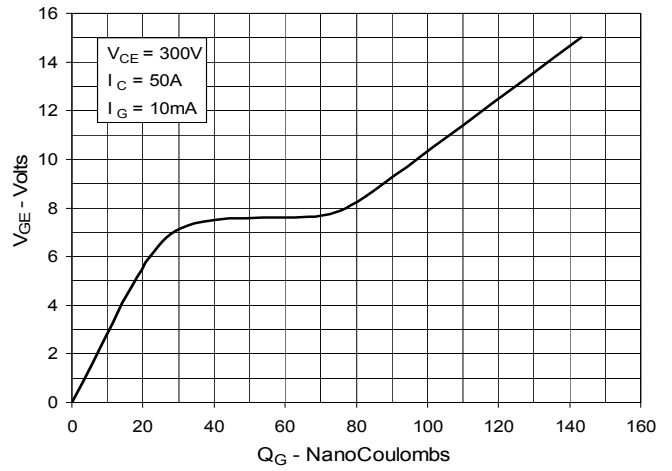
|  |           |           |           |           |              |              |              |              |              |             |
|--|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| IXYS MOSFETs and 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  
@ 25°C**

**Fig. 2. Extended Output Characteristics  
@ 25°C**

**Fig. 3. Output Characteristics  
@ 125°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**


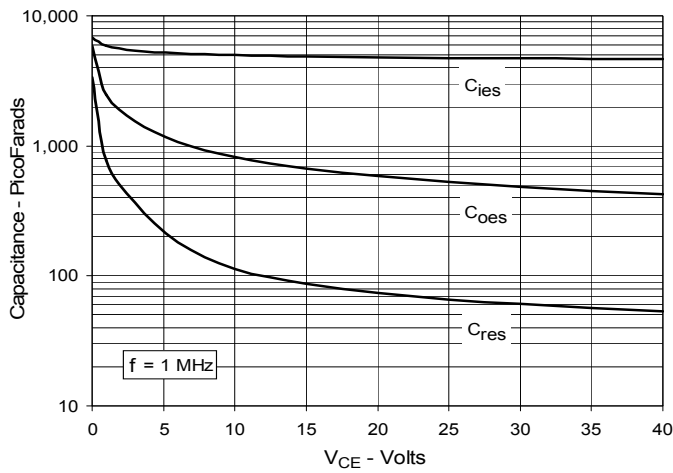
**Fig. 7. Transconductance**



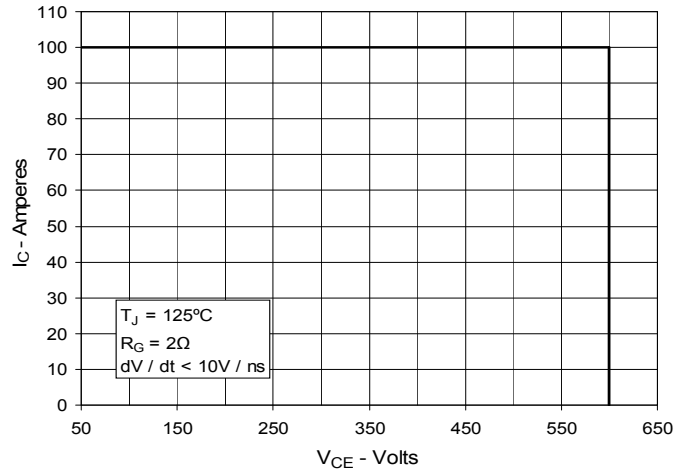
**Fig. 8. Gate Charge**



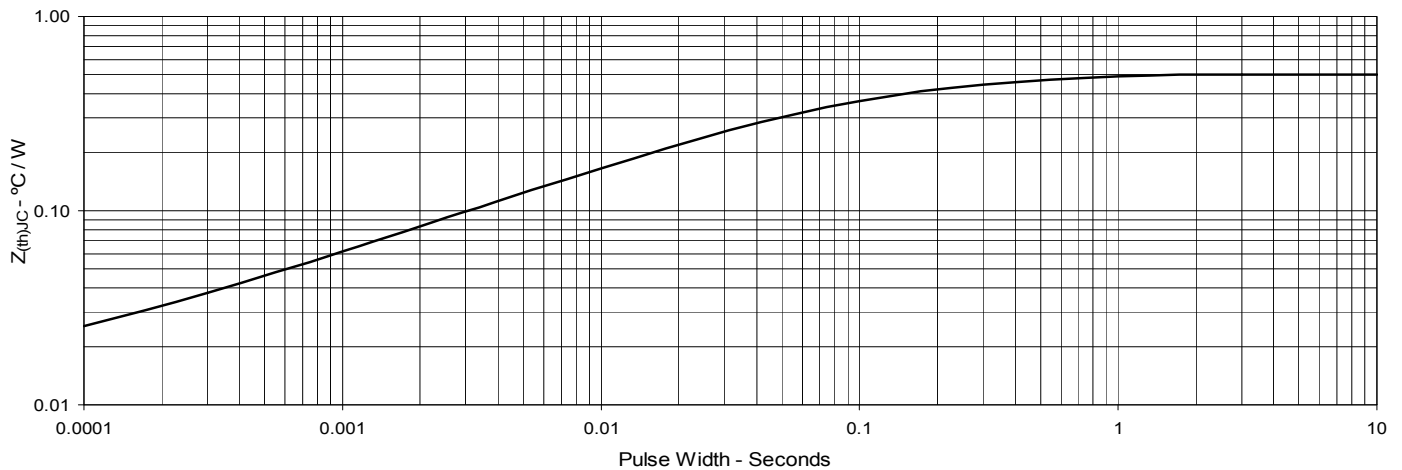
**Fig. 9. Capacitance**

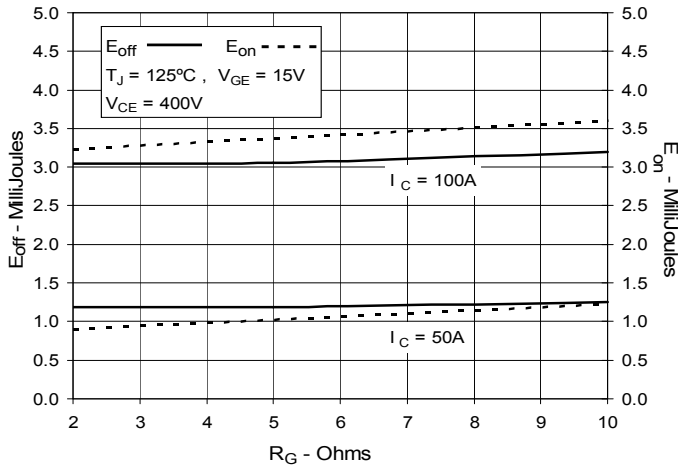
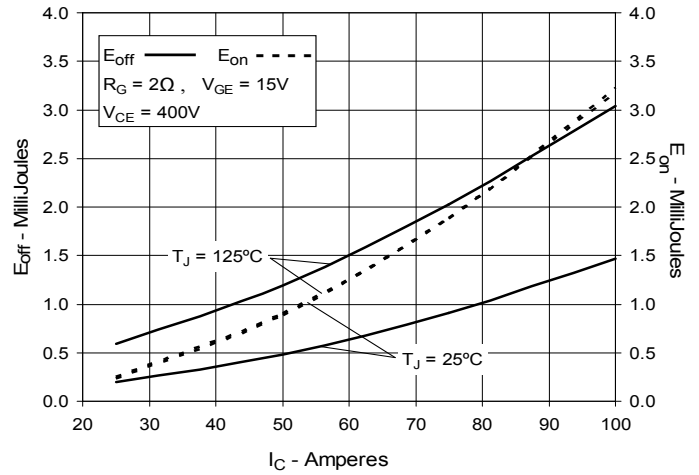
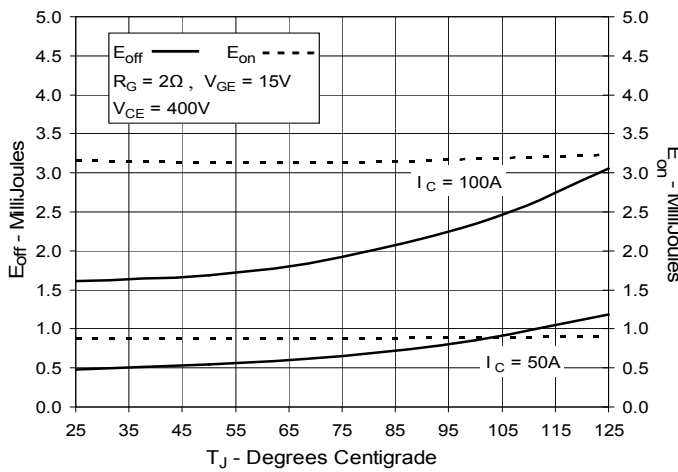
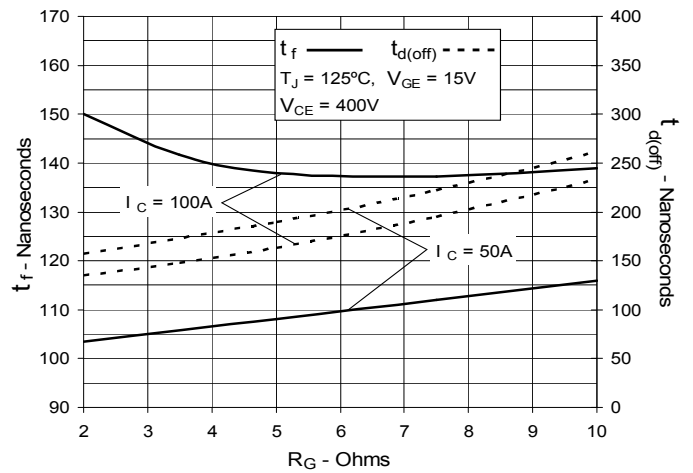
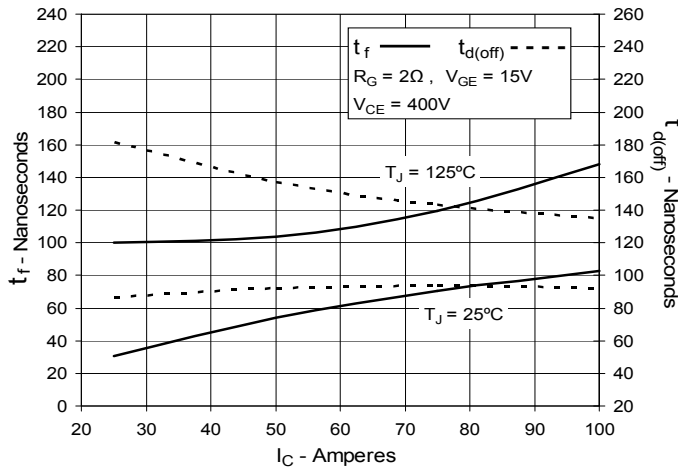
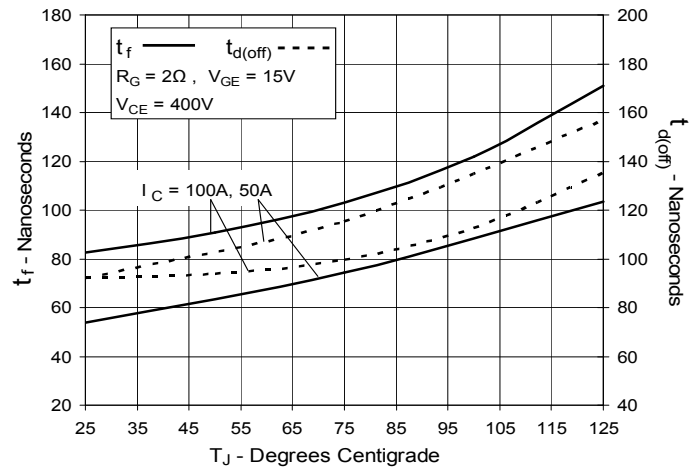


**Fig. 10. Reverse-Bias Safe Operating Area**

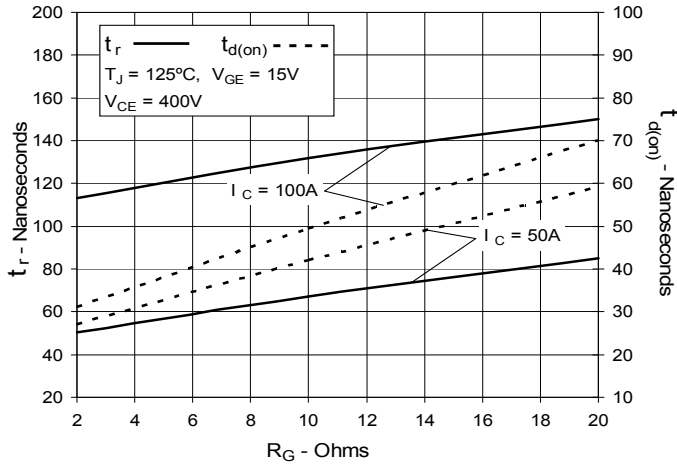


**Fig. 11. Maximum Transient Thermal Impedance for IGBT**

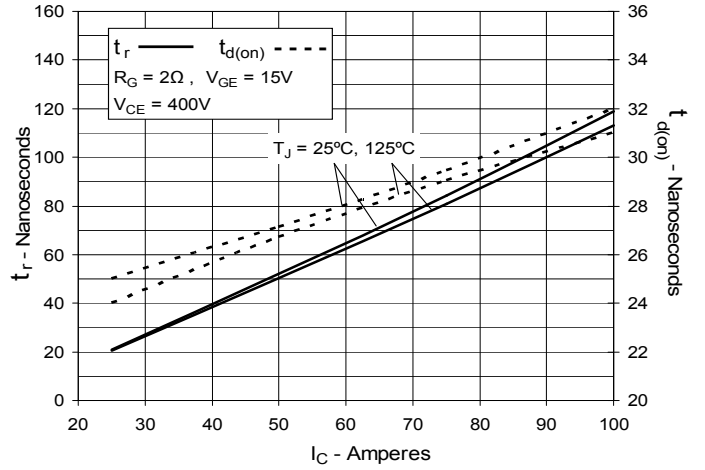


**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**

**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**


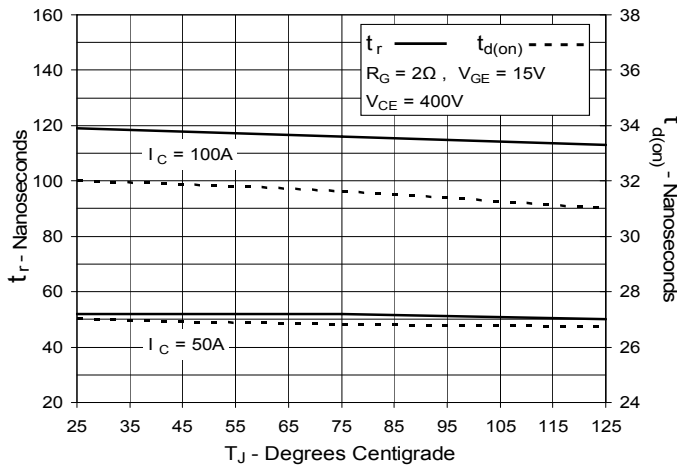
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



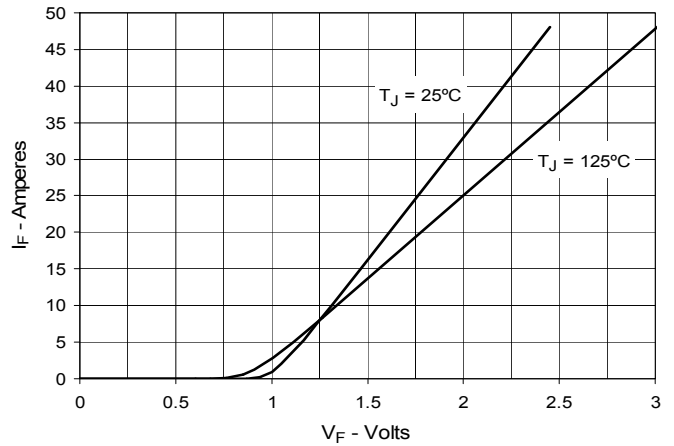
**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**



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



**Fig. 21. Forward Current vs. Forward Voltage**



**Fig. 22. Maximum Transient Thermal Impedance for Diodes**

