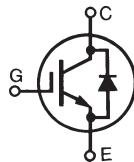


# 1200V XPT™ IGBT GenX3™ w/ Diode

## IXYR50N120C3D1

(Electrically Isolated Tab)

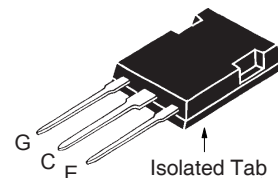
High-Speed IGBT  
for 20-50 kHz Switching



$V_{CES} = 1200V$   
 $I_{C90} = 32A$   
 $V_{CE(sat)} \leq 3.5V$   
 $t_{fi(typ)} = 43ns$

| Symbol         | Test Conditions   | Maximum Ratings         |            |
|----------------|---|-------------------------|------------|
| $V_{CES}$      | $T_J = 25^\circ C$ to $150^\circ C$                       | 1200                    | V          |
| $V_{CGR}$      | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GE} = 1M\Omega$ | 1200                    | V          |
| $V_{GES}$      | Continuous  | $\pm 20$                | V          |
| $V_{GEM}$      | Transient   | $\pm 30$                | V          |
| $I_{C25}$      | $T_C = 25^\circ C$ (Chip Capability)                      | 56                      | A          |
| $I_{C90}$      | $T_C = 90^\circ C$  | 32                      | A          |
| $I_{F110}$     | $T_C = 110^\circ C$                                       | 18                      | A          |
| $I_{CM}$       | $T_C = 25^\circ C$ , 1ms                                  | 210                     | A          |
| <b>SSOA</b>    | $V_{GE} = 15V$ , $T_{VJ} = 150^\circ C$ , $R_G = 5\Omega$ | $I_{CM} = 100$          | A          |
| <b>(RBSOA)</b> | Clamped Inductive Load                                    | @ $V_{CE} \leq V_{CES}$ |            |
| $P_C$          | $T_C = 25^\circ C$  | 290                     | W          |
| $T_J$          |   | -55 ... +150            | $^\circ C$ |
| $T_{JM}$       |   | 150                     | $^\circ C$ |
| $T_{stg}$      |   | -55 ... +150            | $^\circ C$ |
| $T_L$          | Maximum Lead Temperature for Soldering                    | 300                     | $^\circ C$ |
| $T_{SOLD}$     | 1.6 mm (0.062in.) from Case for 10s                       | 260                     | $^\circ C$ |
| $V_{ISOL}$     | 50/60 Hz, 1 Minute  | 2500                    | V~         |
| $F_C$          | Mounting Force  | 20..120/4.5..27         | N/lb.      |
| <b>Weight</b>  |   | 5                       | g          |

### ISOPLUS247™



G = Gate      C = Collector  
E = Emitter

### Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface
- 2500V~ Electrical Isolation
- Optimized for Low Switching Losses
- Square RBSOA
- Positive Thermal Coefficient of  $V_{ce(sat)}$
- Anti-Parallel Ultra Fast Diode
- High Current Handling Capability
- International Standard Package

### Advantages

- High Power Density
- Low Gate Drive Requirement

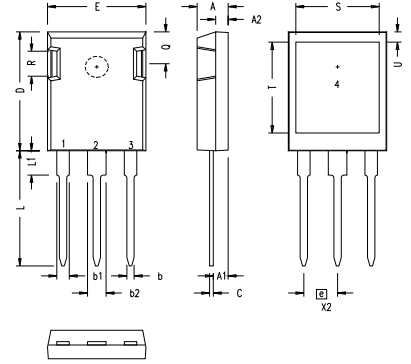
### Applications

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

| Symbol        | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |                           |
|---------------|---|-----------------------|------|---------------------------|
|               |   | Min.                  | Typ. | Max.                      |
| $BV_{CES}$    | $I_C = 250\mu A$ , $V_{GE} = 0V$                                      | 1200                  |      | V                         |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                                  | 3.0                   |      | 5.0 V                     |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 125^\circ C$             |                       |      | 50 $\mu A$<br>500 $\mu A$ |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |      | $\pm 100$ nA              |
| $V_{CE(sat)}$ | $I_C = 50A$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 150^\circ C$          |                       | 4.2  | 3.5 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  | 20                    | 32   | S                  |
| $C_{ies}$  | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$  |                       | 3100 | pF                 |
| $C_{oes}$  |   |                       | 230  | pF                 |
| $C_{res}$  |   |                       | 66   | pF                 |
| $Q_{g(on)}$  | $I_C = 50\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$   |                       | 142  | nC                 |
| $Q_{ge}$   |   |                       | 23   | nC                 |
| $Q_{gc}$   |   |                       | 60   | 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>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 5\Omega$<br>Note 2  |                       | 28   | ns                 |
| $t_{ri}$   |   |                       | 62   | ns                 |
| $E_{on}$   |   |                       | 3.0  | mJ                 |
| $t_{d(off)}$   |   |                       | 133  | ns                 |
| $t_{fi}$   |   |                       | 43   | ns                 |
| $E_{off}$  |   |                       | 1.0  | 1.7 mJ             |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 150^\circ\text{C}</math></b><br>$I_C = 50\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 5\Omega$<br>Note 2 |                       | 28   | ns                 |
| $t_{ri}$   |   |                       | 68   | ns                 |
| $E_{on}$   |   |                       | 6.0  | mJ                 |
| $t_{d(off)}$   |   |                       | 160  | ns                 |
| $t_{fi}$   |   |                       | 60   | ns                 |
| $E_{off}$  |   |                       | 1.4  | mJ                 |
| $R_{thJC}$   |   |                       | 0.43 | $^\circ\text{C/W}$ |
| $R_{thCS}$   |   | 0.15                  |      | $^\circ\text{C/W}$ |

## ISOPLUS247 (IXYR) 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
- 2,4 - Collector
- 3 - Emitter

## Reverse Diode (FRED)

| Symbol Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) |   | Characteristic Value      |      |                         |
|--|---|---------------------------|------|-------------------------|
|  |   | Min.                      | Typ. | Max.                    |
| $V_F$  | $I_F = 30\text{A}, V_{GE} = 0\text{V}$ , Note 1   |                           |      | 3.00 V                  |
|  |   | $T_J = 150^\circ\text{C}$ | 1.75 | V                       |
| $I_{RM}$   | $I_F = 30\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 100\text{A}/\mu\text{s}, V_R = 600\text{V}$ | $T_J = 100^\circ\text{C}$ |      | 9 A                     |
| $t_{rr}$   |   | $T_J = 100^\circ\text{C}$ | 195  |                         |
| $R_{thJC}$   |   |                           |      | 1.10 $^\circ\text{C/W}$ |

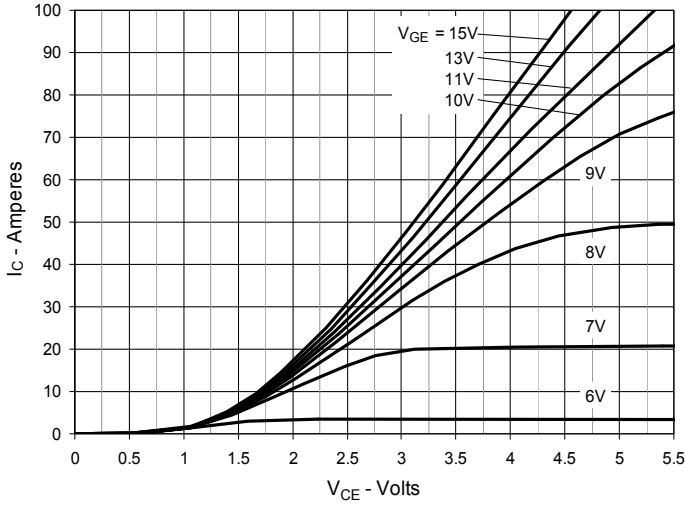
## Notes:

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

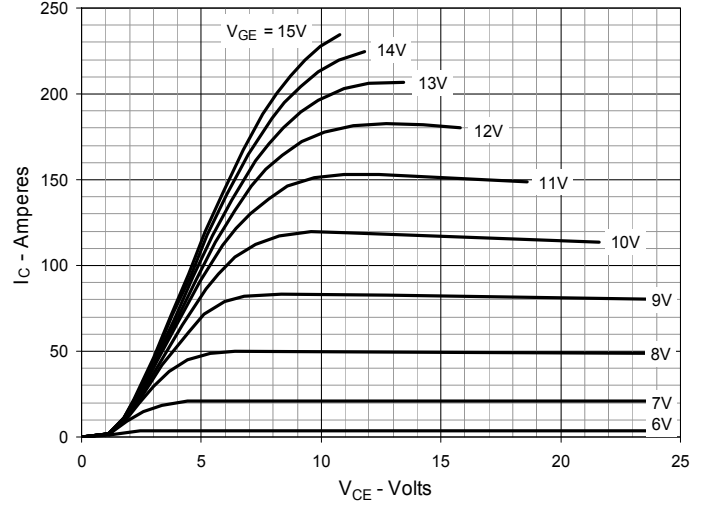
IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

|  |           |           |           |           |              |              |              |              |              |             |
|--|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 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 |
|  | 4,860,072 | 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    |             |

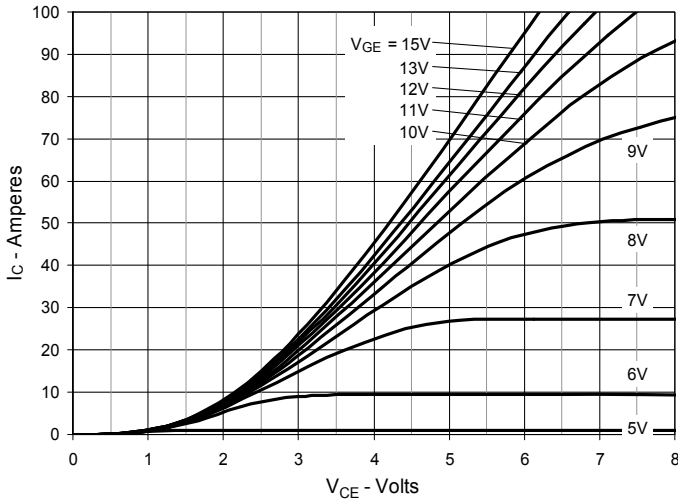
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$**



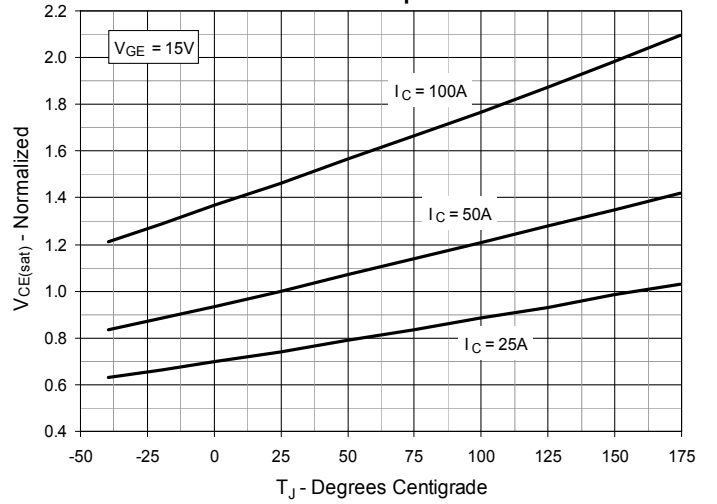
**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$**



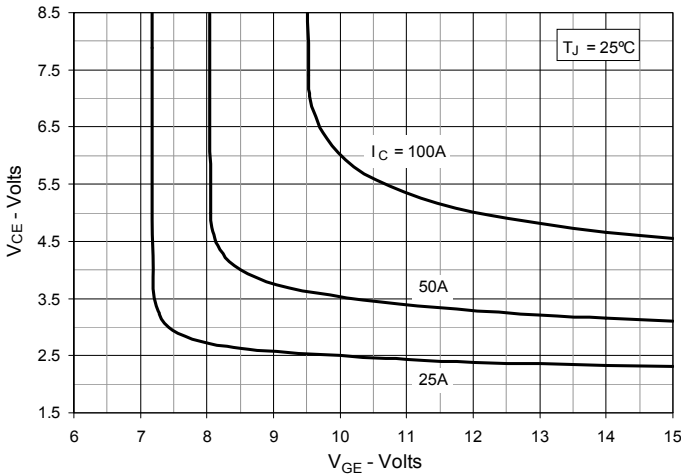
**Fig. 3. Output Characteristics @  $T_J = 150^\circ\text{C}$**



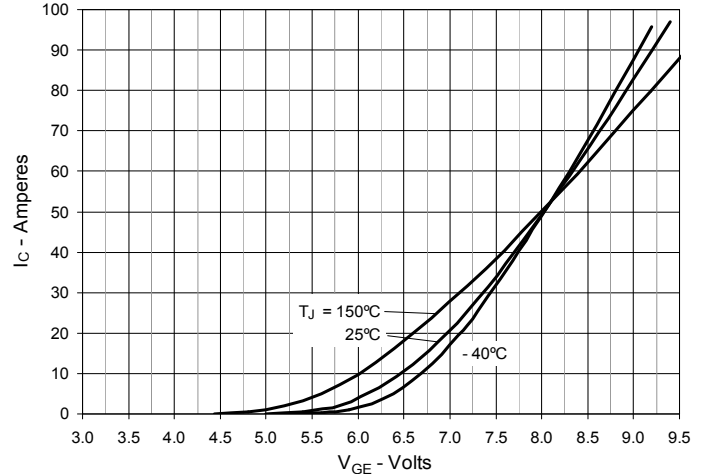
**Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature**

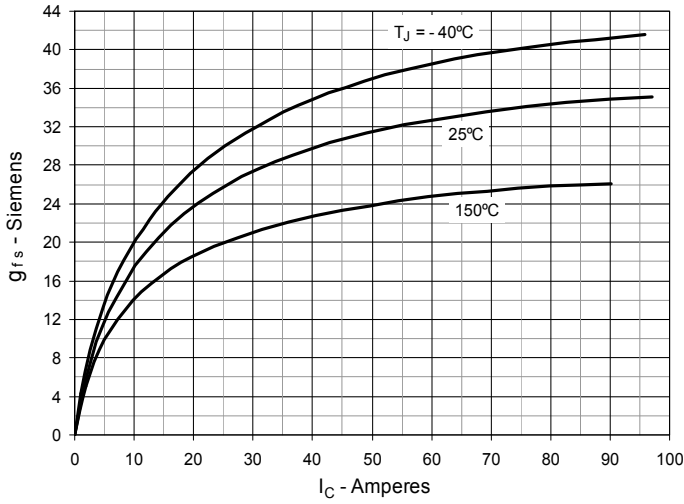
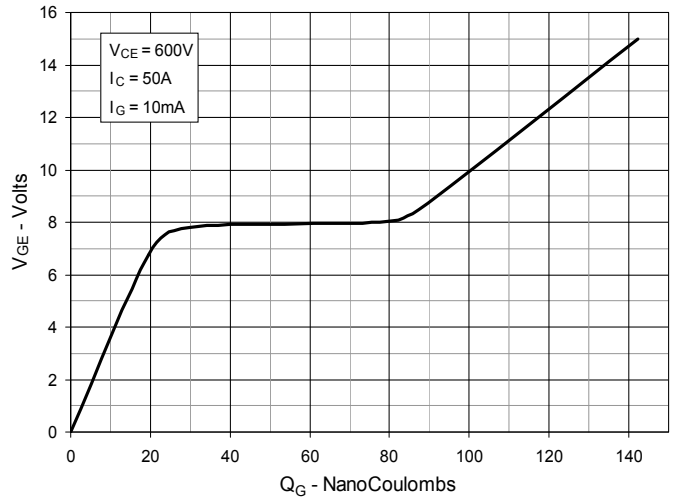
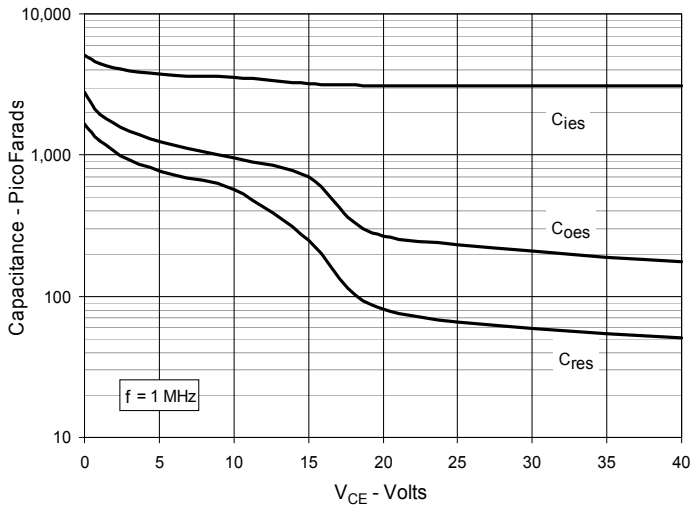
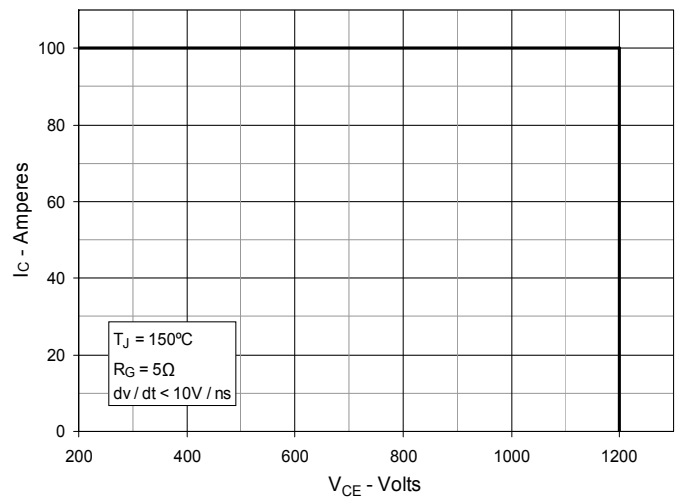
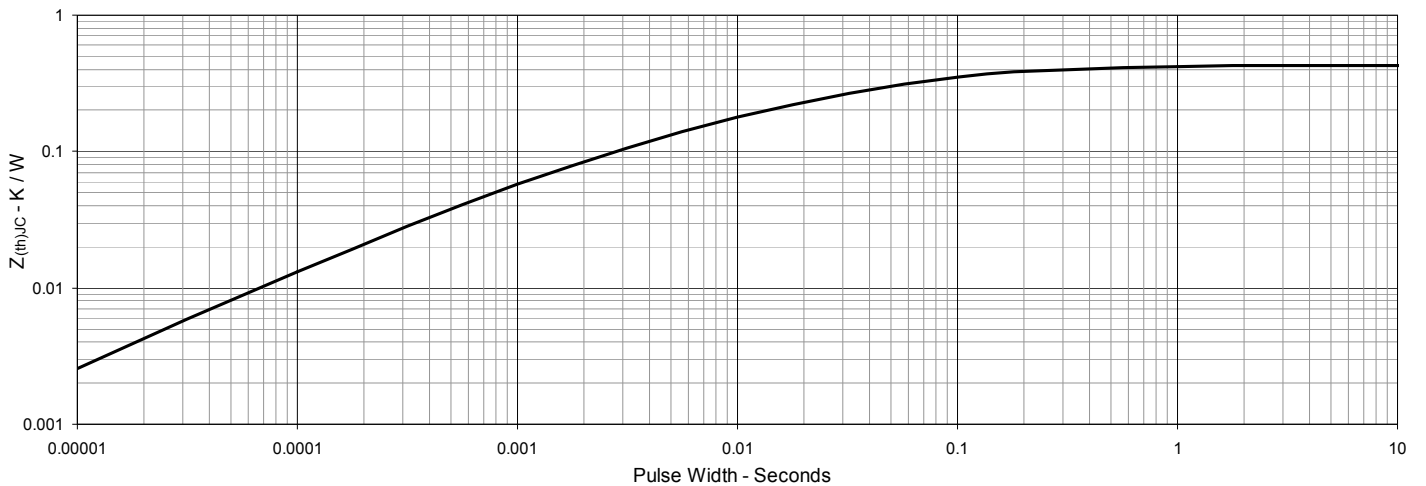


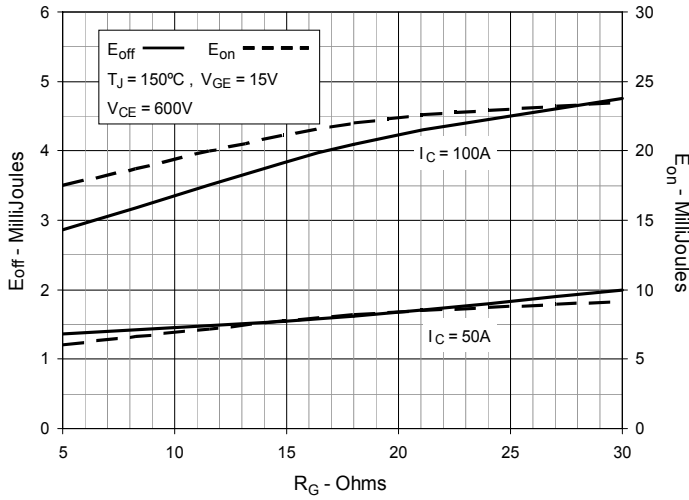
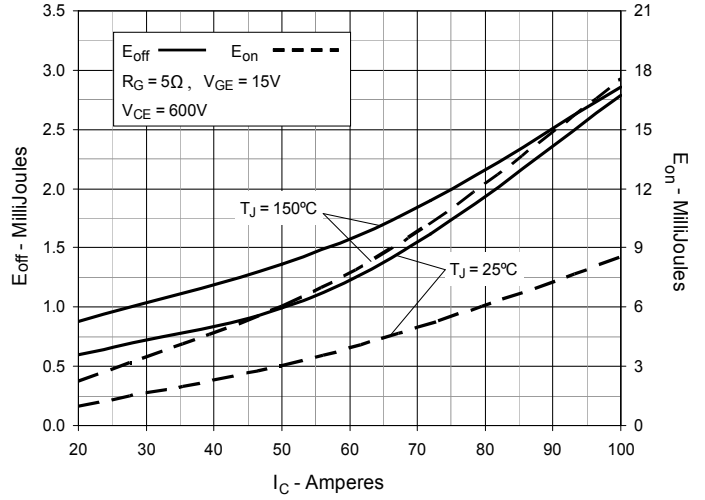
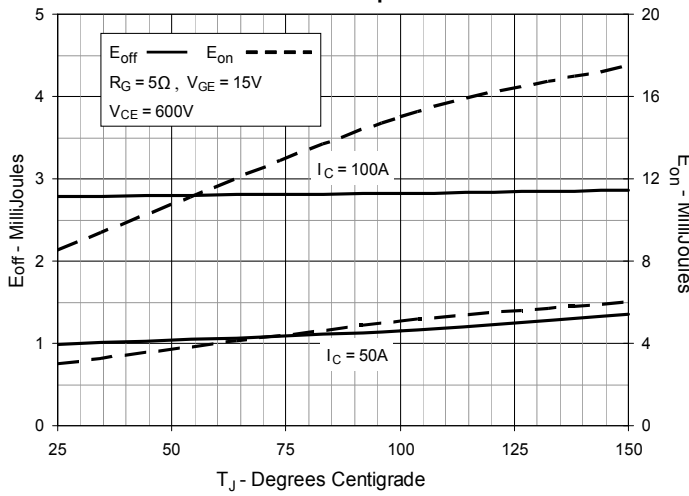
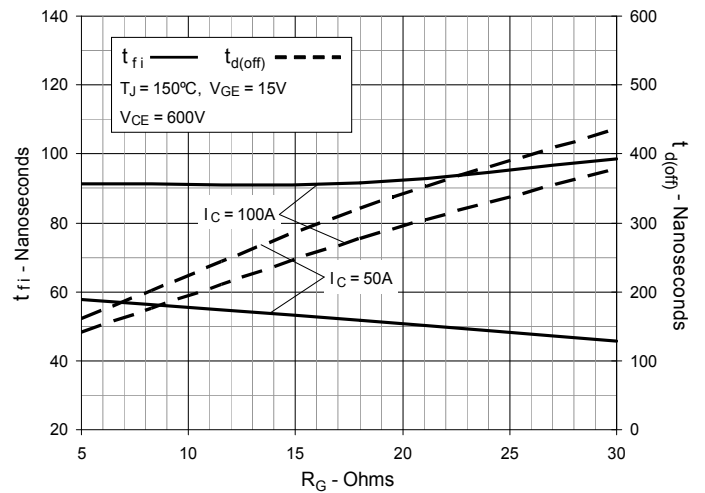
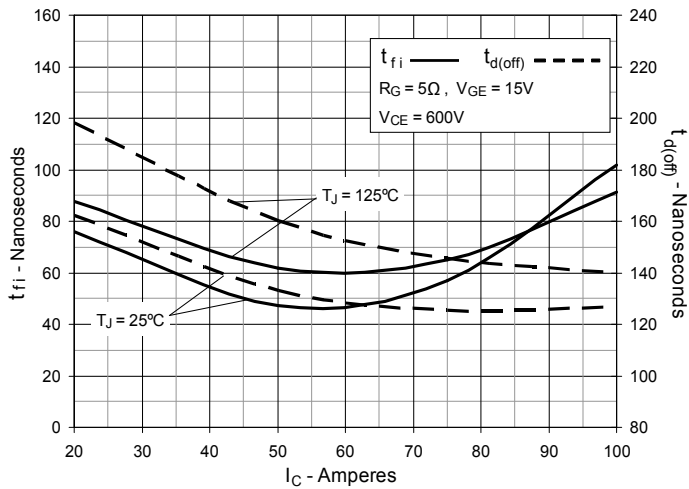
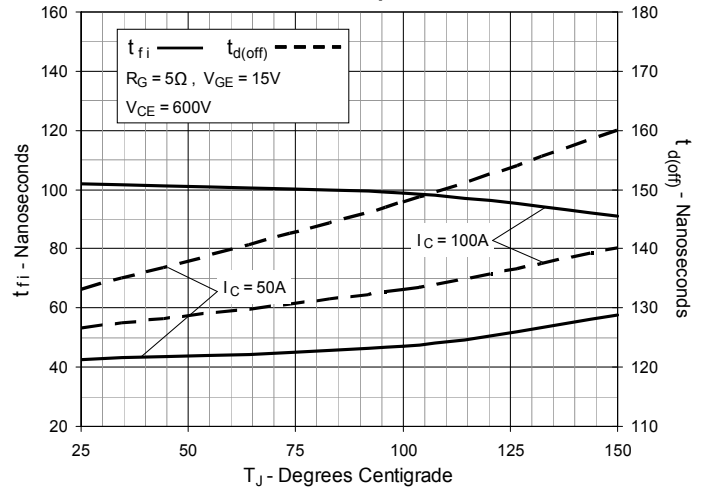
**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**



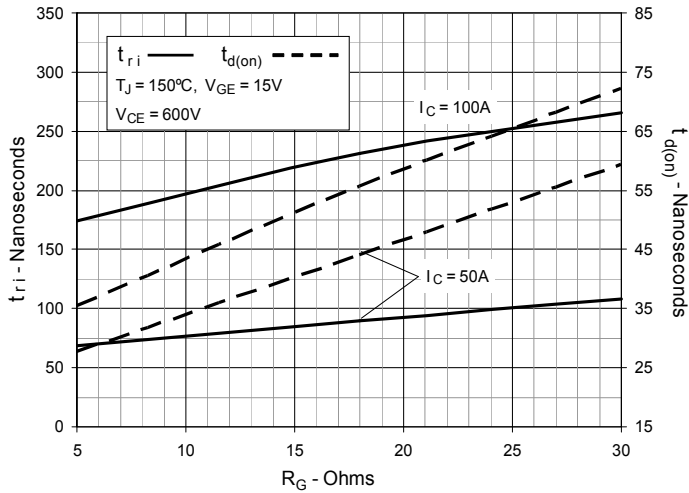
**Fig. 6. Input Admittance**



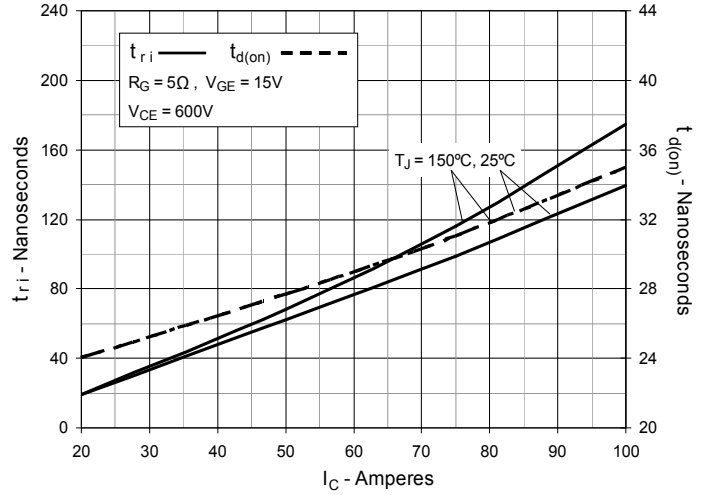
**Fig. 7. Transconductance**

**Fig. 8. Gate Charge**

**Fig. 9. Capacitance**

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

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


**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**


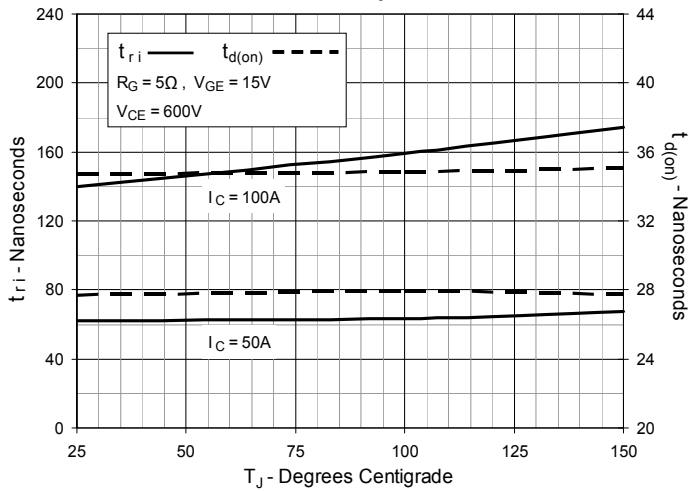
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



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



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



**Fig. 21. Maximum Transient Thermal Impedance (Diode)**

