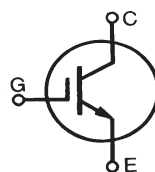


# XPT™ 900V IGBT GenX3™

## IXYH60N90C3

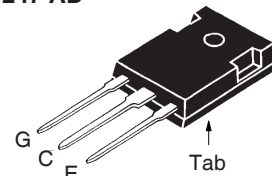
High-Speed IGBT  
for 20-50 kHz Switching



$$\begin{aligned} V_{CES} &= 900V \\ I_{C110} &= 60A \\ V_{CE(sat)} &\leq 2.9V \\ t_{fi(typ)} &= 88ns \end{aligned}$$

| Symbol                        | Test Conditions                                                                     | Maximum Ratings                           |                  |
|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------|------------------|
| $V_{CES}$                     | $T_J = 25^\circ\text{C to } 175^\circ\text{C}$                                      | 900                                       | V                |
| $V_{CGR}$                     | $T_J = 25^\circ\text{C to } 175^\circ\text{C}, R_{GE} = 1M\Omega$                   | 900                                       | V                |
| $V_{GES}$                     | Continuous                                                                          | $\pm 20$                                  | V                |
| $V_{GEM}$                     | Transient                                                                           | $\pm 30$                                  | V                |
| $I_{C25}$                     | $T_C = 25^\circ\text{C}$ (Chip Capability)                                          | 140                                       | A                |
| $I_{C110}$                    | $T_C = 110^\circ\text{C}$                                                           | 60                                        | A                |
| $I_{CM}$                      | $T_C = 25^\circ\text{C}, 1\text{ms}$                                                | 310                                       | A                |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V, T_{VJ} = 150^\circ\text{C}, R_G = 3\Omega$<br>Clamped Inductive Load | $I_{CM} = 120$<br>$@ V_{CE} \leq V_{CES}$ | A                |
| $P_C$                         | $T_C = 25^\circ\text{C}$                                                            | 750                                       | W                |
| $T_J$                         |                                                                                     | -55 ... +175                              | $^\circ\text{C}$ |
| $T_{JM}$                      |                                                                                     | 175                                       | $^\circ\text{C}$ |
| $T_{stg}$                     |                                                                                     | -55 ... +175                              | $^\circ\text{C}$ |
| $T_L$                         | Maximum Lead Temperature for Soldering                                              | 300                                       | $^\circ\text{C}$ |
| $T_{SOLD}$                    | 1.6 mm (0.062in.) from Case for 10s                                                 | 260                                       | $^\circ\text{C}$ |
| $M_d$                         | Mounting Torque                                                                     | 1.13/10                                   | Nm/lb.in.        |
| <b>Weight</b>                 |                                                                                     | 6                                         | g                |

### TO-247 AD



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

### Features

- Optimized for Low Switching Losses
- Square RBSOA
- Positive Thermal Coefficient of  $V_{ce(sat)}$
- 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>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |            |                                       |
|---------------|-----------------------------------------------------------------------------|-----------------------|------------|---------------------------------------|
|               |                                                                             | Min.                  | Typ.       | Max.                                  |
| $BV_{CES}$    | $I_C = 250\mu\text{A}, V_{GE} = 0V$                                         | 950                   |            | V                                     |
| $V_{GE(th)}$  | $I_C = 250\mu\text{A}, V_{CE} = V_{GE}$                                     | 3.5                   |            | 5.5 V                                 |
| $I_{CES}$     | $V_{CE} = V_{CES}, V_{GE} = 0V$<br>$T_J = 150^\circ\text{C}$                |                       |            | 25 $\mu\text{A}$<br>750 $\mu\text{A}$ |
| $I_{GES}$     | $V_{CE} = 0V, V_{GE} = \pm 20V$                                             |                       |            | $\pm 100$ nA                          |
| $V_{CE(sat)}$ | $I_C = 60A, V_{GE} = 15V$ , Note 1<br>$T_J = 150^\circ\text{C}$             |                       | 2.4<br>2.9 | 2.9 V<br>V                            |

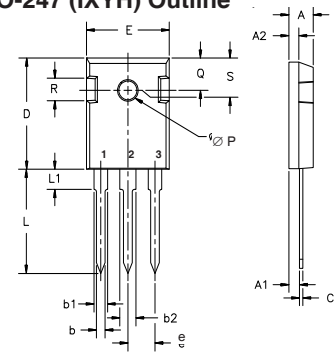
## Symbol Test Conditions

( $T_J = 25^\circ\text{C}$  Unless Otherwise Specified)

## Characteristic Values

|              |                                                                                                                                                                 | Min. | Typ. | Max.                    |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-------------------------|
| $g_{fs}$     | $I_C = 60\text{A}, V_{CE} = 10\text{V}, \text{Note 1}$                                                                                                          | 20   | 34   | S                       |
| $C_{ies}$    | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                                      |      | 3285 | pF                      |
| $C_{oes}$    |                                                                                                                                                                 |      | 175  | pF                      |
| $C_{res}$    |                                                                                                                                                                 |      | 56   | pF                      |
| $Q_{g(on)}$  | $I_C = 60\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                                             |      | 107  | nC                      |
| $Q_{ge}$     |                                                                                                                                                                 |      | 30   | nC                      |
| $Q_{gc}$     |                                                                                                                                                                 |      | 50   | nC                      |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 60\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 3\Omega$<br>Note 2  |      | 30   | ns                      |
| $t_{ri}$     |                                                                                                                                                                 |      | 77   | ns                      |
| $E_{on}$     |                                                                                                                                                                 |      | 2.70 | mJ                      |
| $t_{d(off)}$ |                                                                                                                                                                 |      | 87   | ns                      |
| $t_{fi}$     |                                                                                                                                                                 |      | 88   | ns                      |
| $E_{off}$    |                                                                                                                                                                 |      | 1.55 | mJ                      |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 150^\circ\text{C}</math></b><br>$I_C = 60\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 3\Omega$<br>Note 2 |      | 30   | ns                      |
| $t_{ri}$     |                                                                                                                                                                 |      | 74   | ns                      |
| $E_{on}$     |                                                                                                                                                                 |      | 4.70 | mJ                      |
| $t_{d(off)}$ |                                                                                                                                                                 |      | 103  | ns                      |
| $t_{fi}$     |                                                                                                                                                                 |      | 165  | ns                      |
| $E_{off}$    |                                                                                                                                                                 |      | 2.15 | mJ                      |
| $R_{thJC}$   |                                                                                                                                                                 |      |      | 0.20 $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                                 |      | 0.21 | $^\circ\text{C/W}$      |

## TO-247 (IXYH) Outline



Terminals: 1 - Gate 2 - Collector  
3 - Emitter

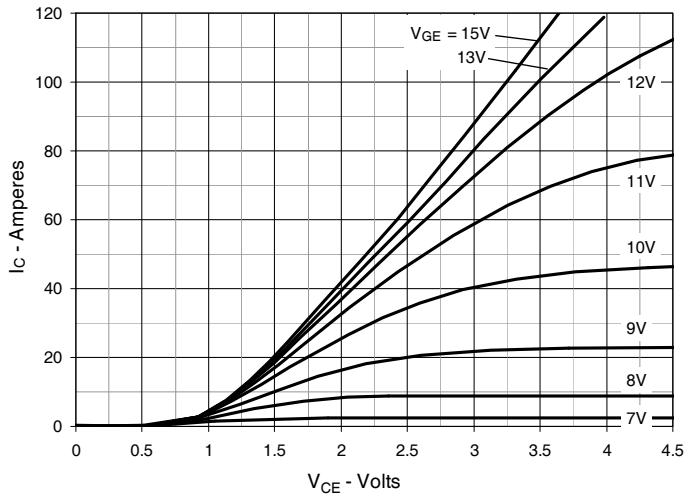
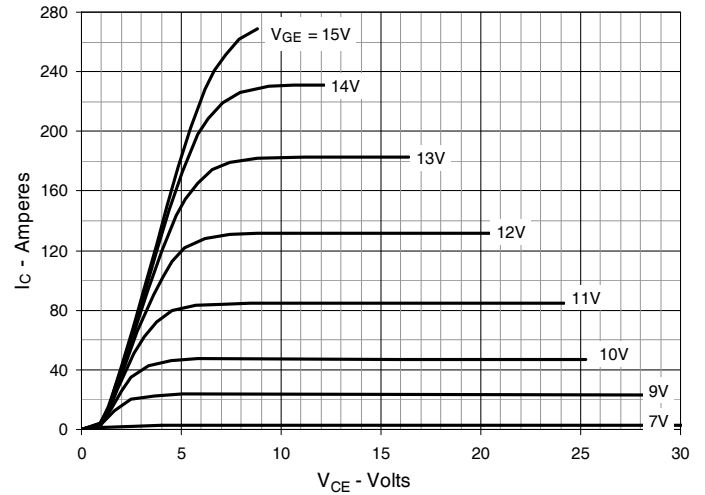
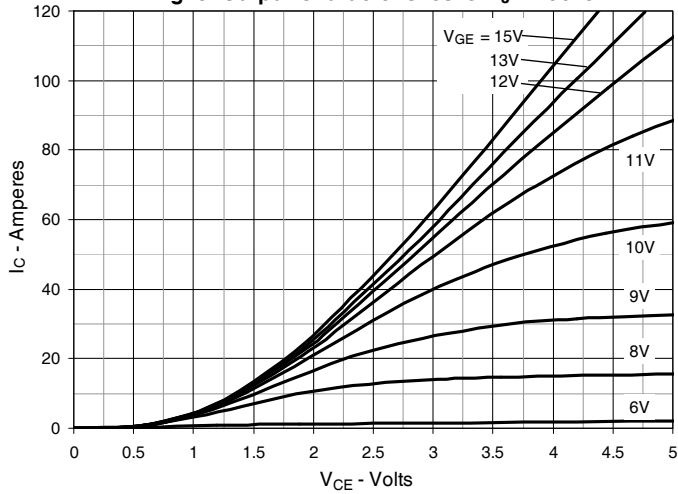
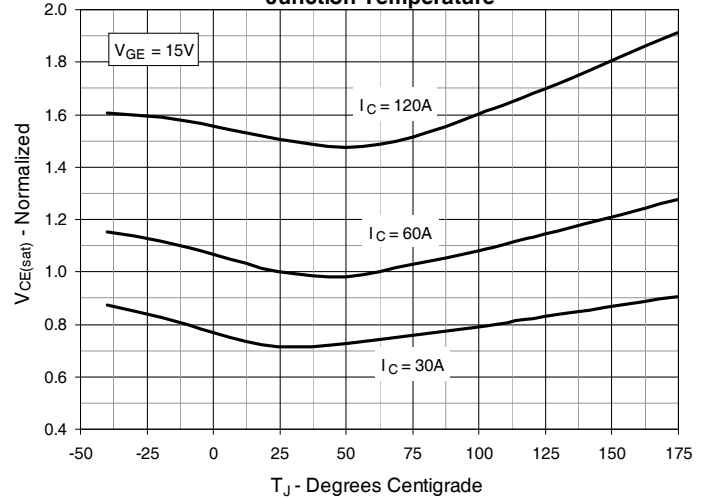
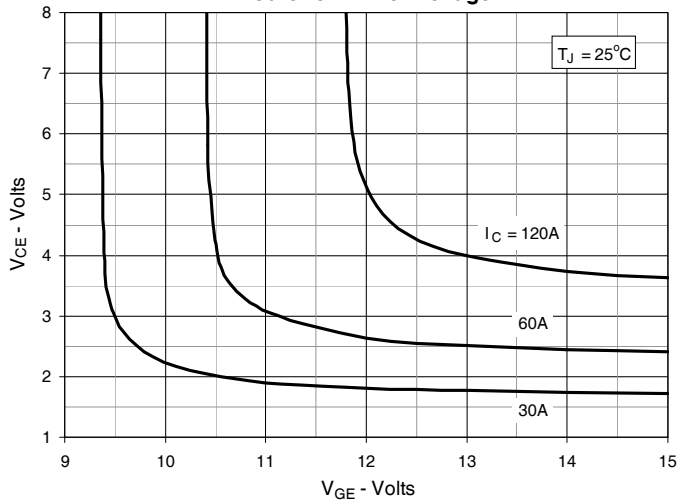
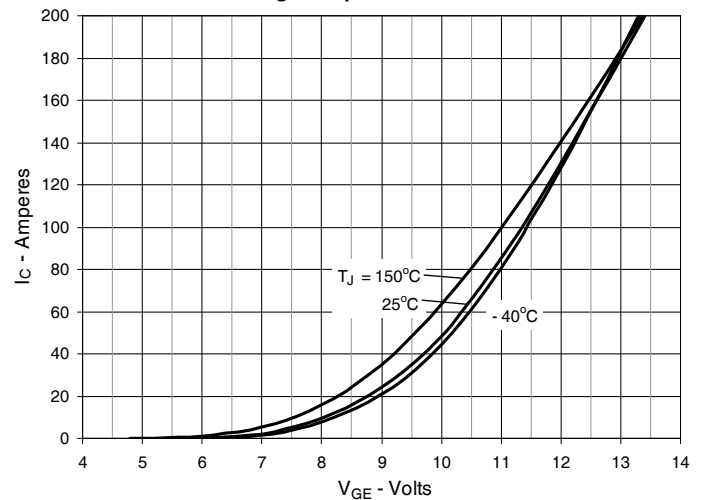
| Dim.           | Millimeter  | Inches      |
|----------------|-------------|-------------|
|                | Min. Max.   | Min. Max.   |
| A              | 4.7 5.3     | .185 .209   |
| A <sub>1</sub> | 2.2 2.54    | .087 .102   |
| A <sub>2</sub> | 2.2 2.6     | .059 .098   |
| b              | 1.0 1.4     | .040 .055   |
| b <sub>1</sub> | 1.65 2.13   | .065 .084   |
| b <sub>2</sub> | 2.87 3.12   | .113 .123   |
| C              | .4 .8       | .016 .031   |
| D              | 20.80 21.46 | .819 .845   |
| E              | 15.75 16.26 | .610 .640   |
| e              | 5.20 5.72   | 0.205 0.225 |
| L              | 19.81 20.32 | .780 .800   |
| L1             | 4.50        | .177        |
| ØP             | 3.55 3.65   | .140 .144   |
| Q              | 5.89 6.40   | 0.232 0.252 |
| R              | 4.32 5.49   | .170 .216   |
| S              | 6.15 BSC    | .242 BSC    |

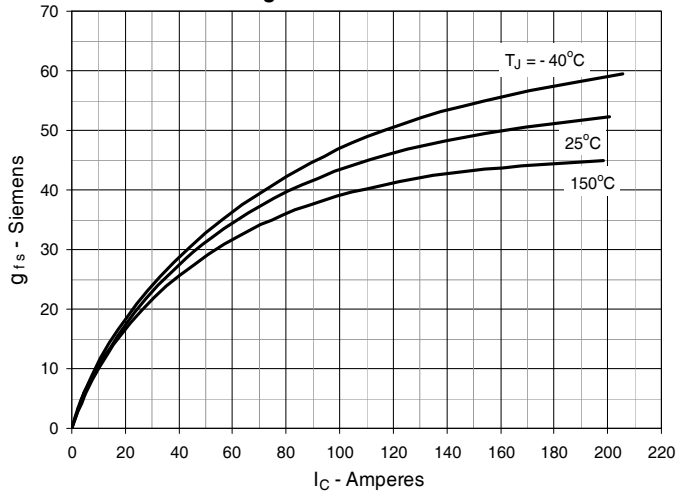
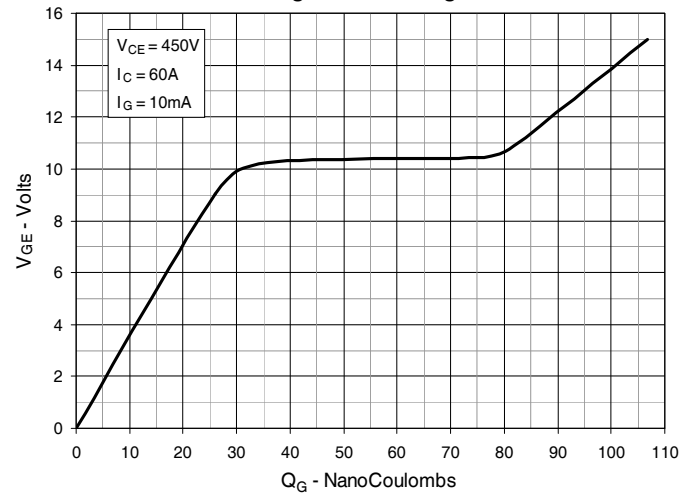
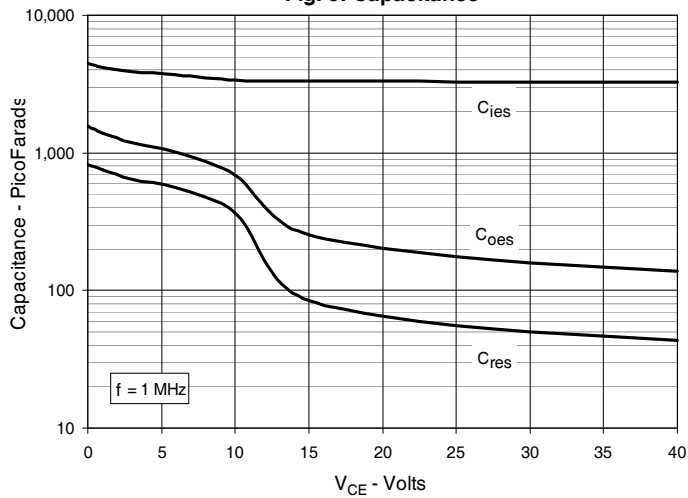
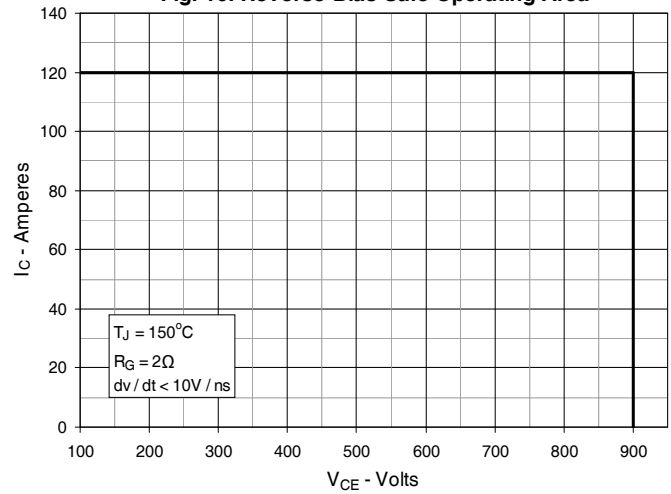
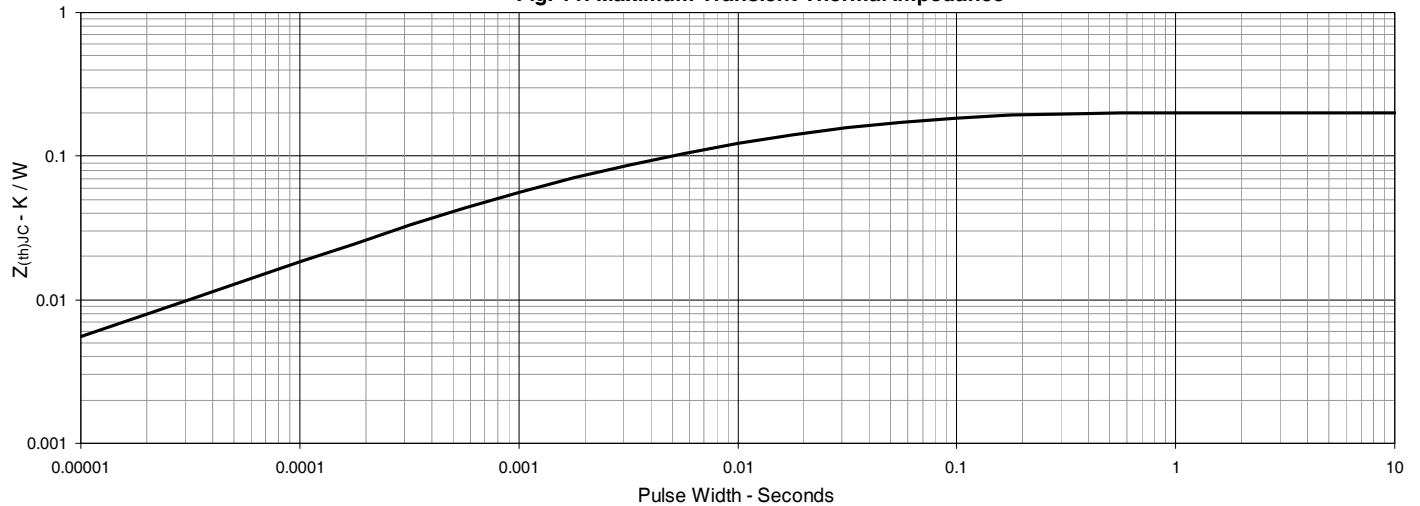
## Notes:

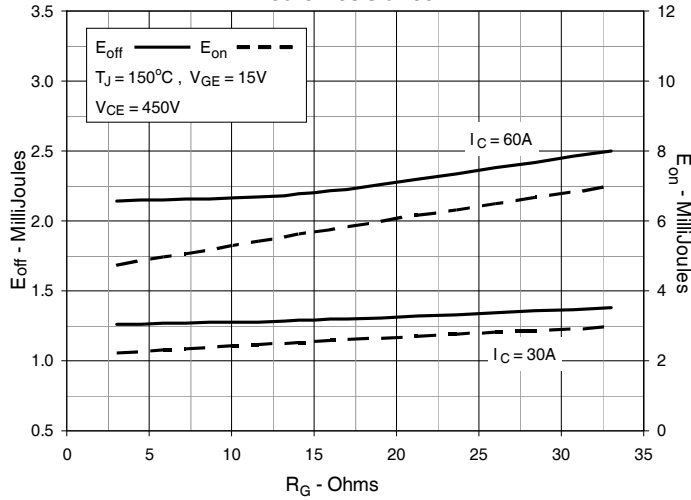
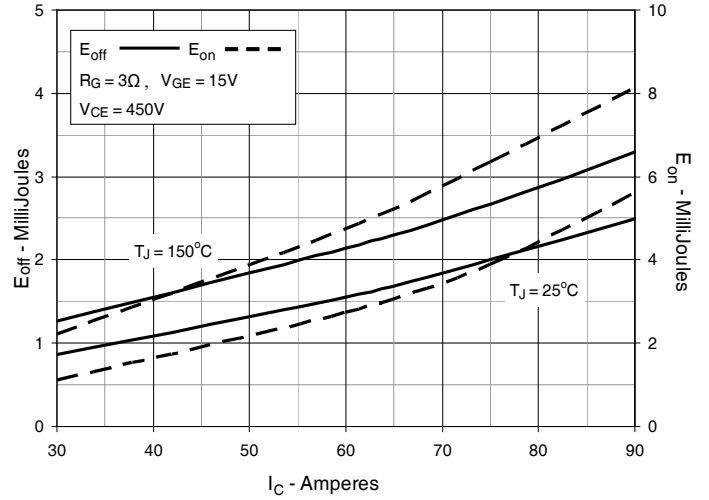
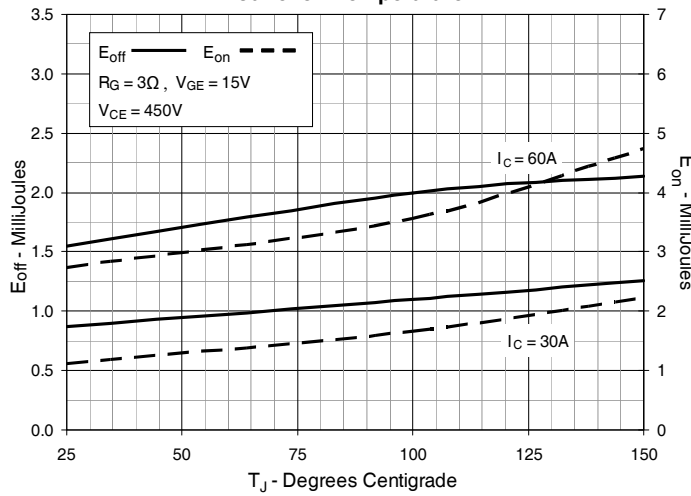
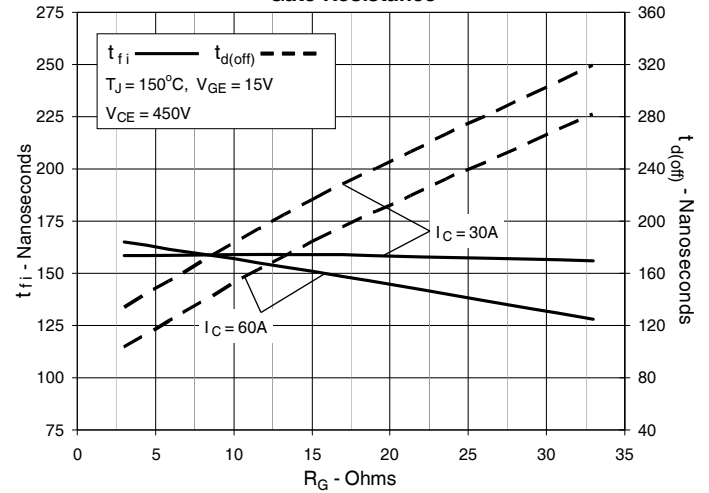
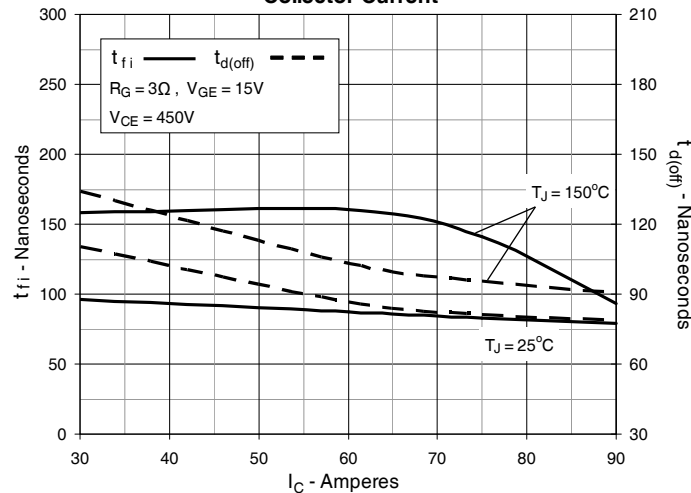
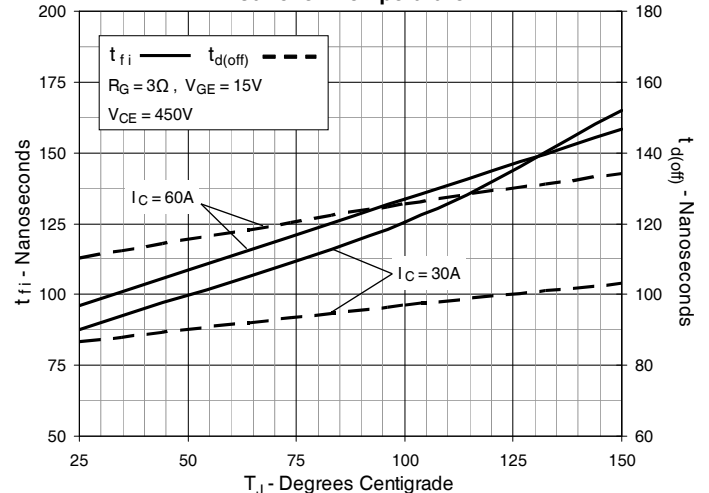
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}(\text{clamp})$ ,  $T_J$  or  $R_G$ .

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

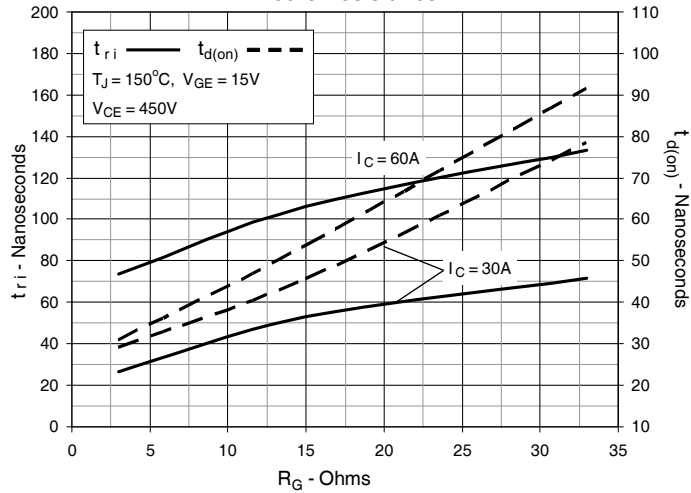
|                                                                                  |           |           |           |           |              |              |              |              |              |             |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 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**


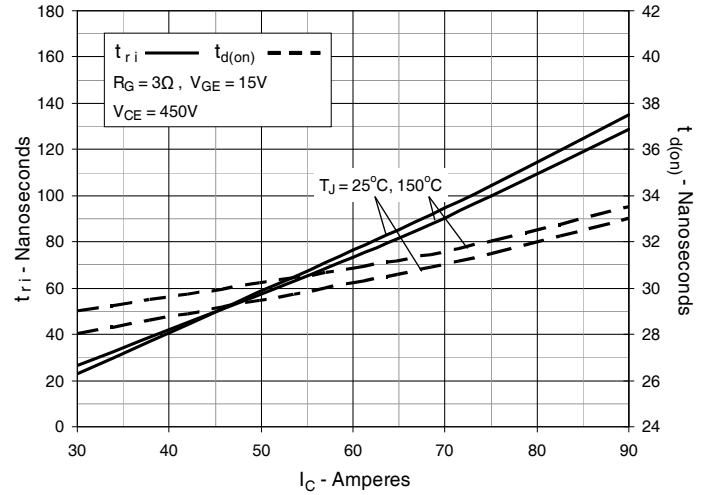
**Fig. 7. Transconductance**

**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**


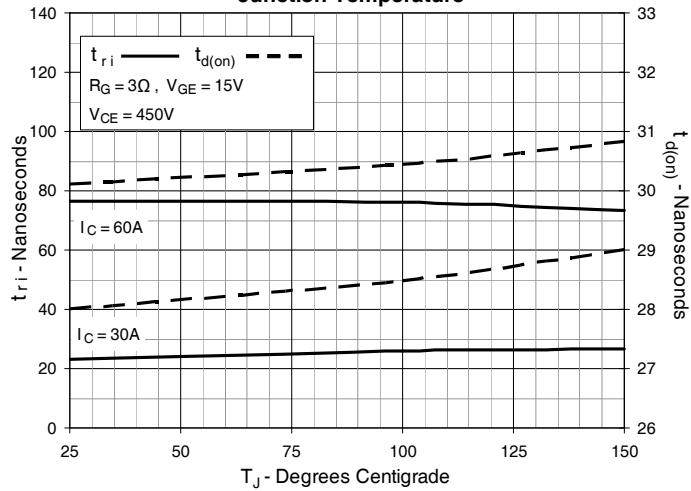
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



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



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





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