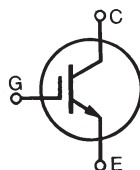


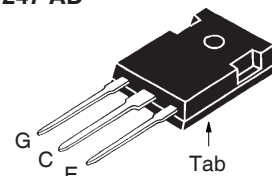
**V<sub>CES</sub> = 600V**  
**I<sub>C110</sub> = 100A**  
**V<sub>CE(sat)</sub> ≤ 1.80V**  
**t<sub>fi(typ)</sub> = 150ns**

Extreme Light Punch Through  
IGBT for 10-30 kHz Switching



| Symbol                            | Test Conditions   | Maximum Ratings                               |           |
|-----------------------------------|---|---|-----------|
| V <sub>CES</sub>                  | T <sub>J</sub> = 25°C to 175°C  | 600   | V         |
| V <sub>CGR</sub>                  | T <sub>J</sub> = 25°C to 175°C, R <sub>GE</sub> = 1MΩ   | 600   | V         |
| V <sub>GES</sub>                  | Continuous  | ±20   | V         |
| V <sub>GEM</sub>                  | Transient   | ±30   | V         |
| I <sub>C25</sub>                  | T <sub>C</sub> = 25°C (Chip Capability)   | 220   | A         |
| I <sub>LRMS</sub>                 | Terminal Current Limit  | 160   | A         |
| I <sub>C110</sub>                 | T <sub>C</sub> = 110°C  | 100   | A         |
| I <sub>CM</sub>                   | T <sub>C</sub> = 25°C, 1ms  | 480   | A         |
| I <sub>A</sub>                    | T <sub>C</sub> = 25°C   | 50  | A         |
| E <sub>AS</sub>                   | T <sub>C</sub> = 25°C   | 600   | mJ        |
| <b>SSOA</b><br><b>(RBSOA)</b>     | V <sub>GE</sub> = 15V, T <sub>VJ</sub> = 150°C, R <sub>G</sub> = 2Ω<br>Clamped Inductive Load                 | I <sub>CM</sub> = 200<br>@ ≤ V <sub>CES</sub> | A         |
| t <sub>sc</sub><br><b>(SCSOA)</b> | V <sub>GE</sub> = 15V, V <sub>CE</sub> = 360V, T <sub>J</sub> = 150°C<br>R <sub>G</sub> = 10Ω, Non Repetitive | 10  | μs        |
| P <sub>C</sub>                    | T <sub>C</sub> = 25°C   | 830   | W         |
| T <sub>J</sub>                    |   | -55 ... +175                                  | °C        |
| T <sub>JM</sub>                   |   | 175   | °C        |
| T <sub>stg</sub>                  |   | -55 ... +175                                  | °C        |
| T <sub>L</sub>                    | Maximum Lead Temperature for Soldering  | 300   | °C        |
| T <sub>SOLD</sub>                 | 1.6 mm (0.062in.) from Case for 10s   | 260   | °C        |
| M <sub>d</sub>                    | 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 10-30kHz Switching
- Square RBSOA
- Avalanche Rated
- Short Circuit Capability
- High Current Handling Capability
- International Standard Package

**Advantages**

- High Power Density
- Low Gate Drive Requirement

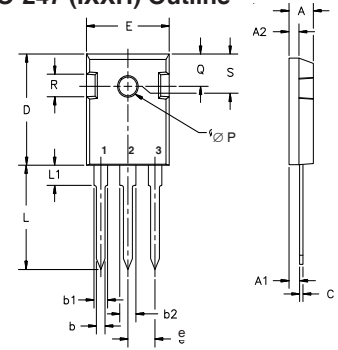
**Applications**

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

| Symbol               | Test Conditions<br>(T <sub>J</sub> = 25°C, Unless Otherwise Specified)              | Characteristic Values |      |               |
|----------------------|---|-----------------------|------|---------------|
|                      |   | Min.                  | Typ. | Max.          |
| BV <sub>CES</sub>    | I <sub>C</sub> = 250μA, V <sub>GE</sub> = 0V  | 600                   |      | V             |
| V <sub>GE(th)</sub>  | I <sub>C</sub> = 250μA, V <sub>CE</sub> = V <sub>GE</sub>                           | 3.0                   |      | 5.5 V         |
| I <sub>CES</sub>     | V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V<br>T <sub>J</sub> = 150°C |                       |      | 25 μA<br>2 mA |
| I <sub>GES</sub>     | V <sub>CE</sub> = 0V, V <sub>GE</sub> = ±20V  |                       |      | ±100 nA       |
| V <sub>CE(sat)</sub> | I <sub>C</sub> = 70A, V <sub>GE</sub> = 15V, Note 1<br>T <sub>J</sub> = 150°C       | 1.50<br>1.77          |      | V<br>V        |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)   | Characteristic Values |      |                    |
|--------------|---|-----------------------|------|--------------------|
|              |   | Min.                  | Typ. | Max.               |
| $g_{fs}$     | $I_C = 60\text{A}, V_{CE} = 10\text{V}$ , Note 1  | 22                    | 40   | S                  |
| $C_{ies}$    | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$  |                       | 4860 | pF                 |
| $C_{oes}$    |   |                       | 285  | pF                 |
| $C_{res}$    |   |                       | 83   | pF                 |
| $Q_{g(on)}$  | $I_C = 70\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$   |                       | 143  | nC                 |
| $Q_{ge}$     |   |                       | 37   | nC                 |
| $Q_{gc}$     |   |                       | 60   | nC                 |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 70\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 360\text{V}, R_G = 2\Omega$<br>Note 2  |                       | 30   | ns                 |
| $t_{ri}$     |   |                       | 70   | ns                 |
| $E_{on}$     |   |                       | 1.9  | mJ                 |
| $t_{d(off)}$ |   |                       | 120  | ns                 |
| $t_{fi}$     |   |                       | 150  | ns                 |
| $E_{off}$    |   | 2.0                   | 2.8  | mJ                 |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 150^\circ\text{C}</math></b><br>$I_C = 70\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 360\text{V}, R_G = 2\Omega$<br>Note 2 |                       | 32   | ns                 |
| $t_{ri}$     |   |                       | 60   | ns                 |
| $E_{on}$     |   |                       | 2.3  | mJ                 |
| $t_{d(off)}$ |   |                       | 150  | ns                 |
| $t_{fi}$     |   |                       | 200  | ns                 |
| $E_{off}$    |   | 2.8                   | mJ   |                    |
| $R_{thJC}$   |   |                       | 0.18 | $^\circ\text{C/W}$ |
| $R_{thCS}$   |   | 0.21                  |      | $^\circ\text{C/W}$ |

### TO-247 (IXXH) Outline



Terminals: 1 - Gate 2 - Collector  
3 - Emitter

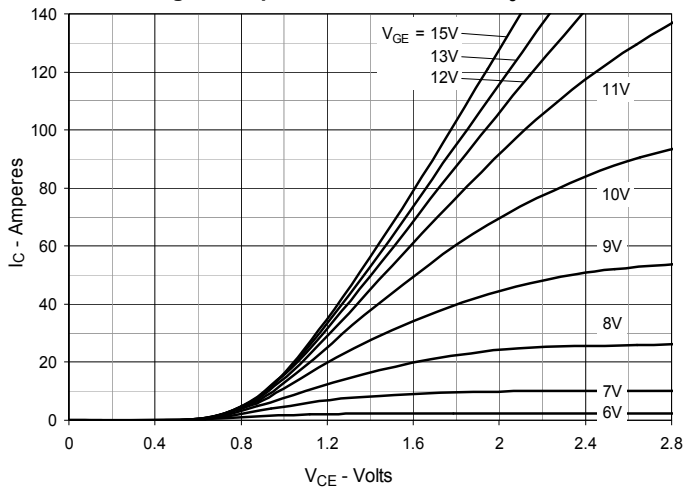
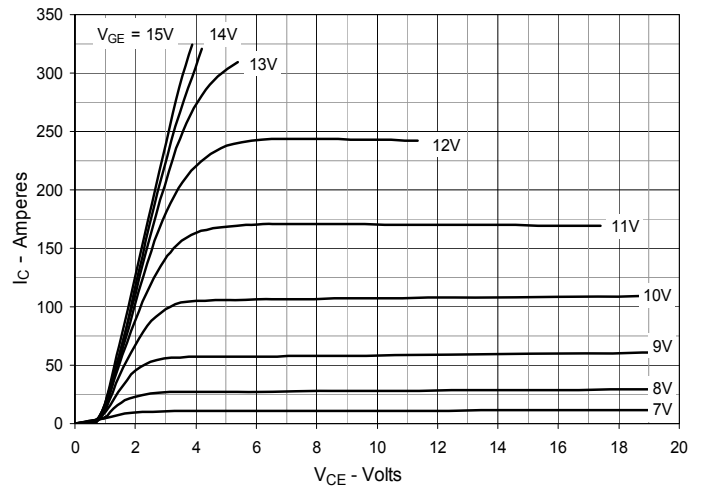
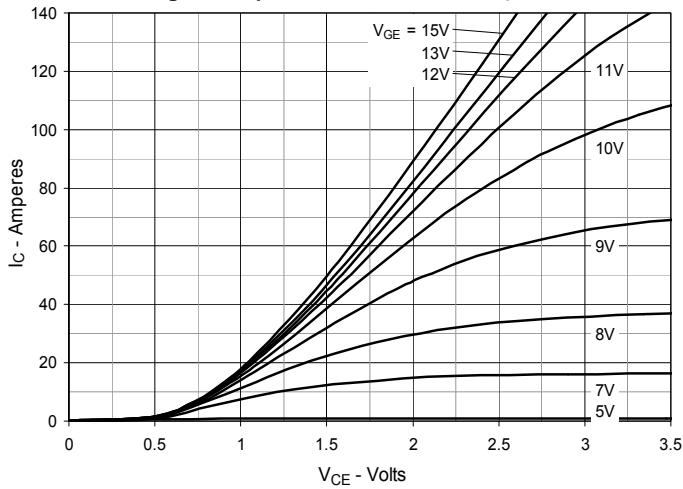
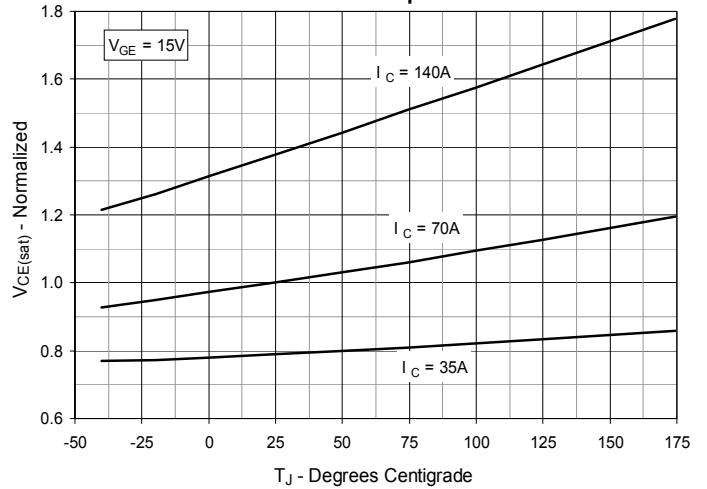
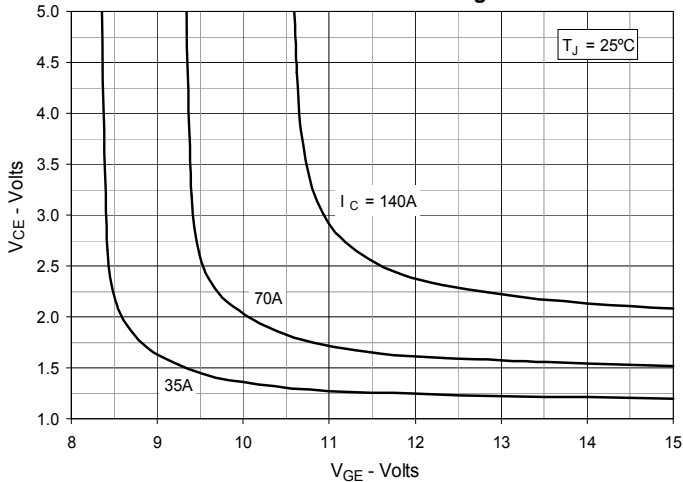
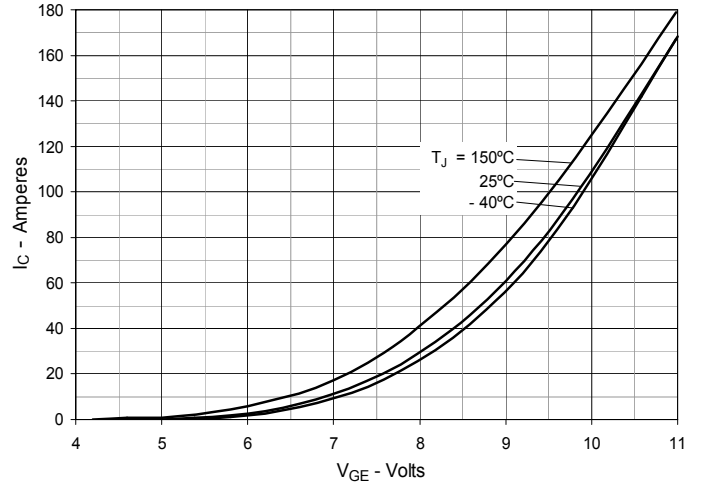
| Dim.           | Millimeter |       | Inches |       |
|----------------|------------|-------|--------|-------|
|                | Min.       | Max.  | Min.   | Max.  |
| A              | 4.7        | 5.3   | .185   | .209  |
| A <sub>1</sub> | 2.2        | 2.54  | .087   | .102  |
| A <sub>2</sub> | 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:

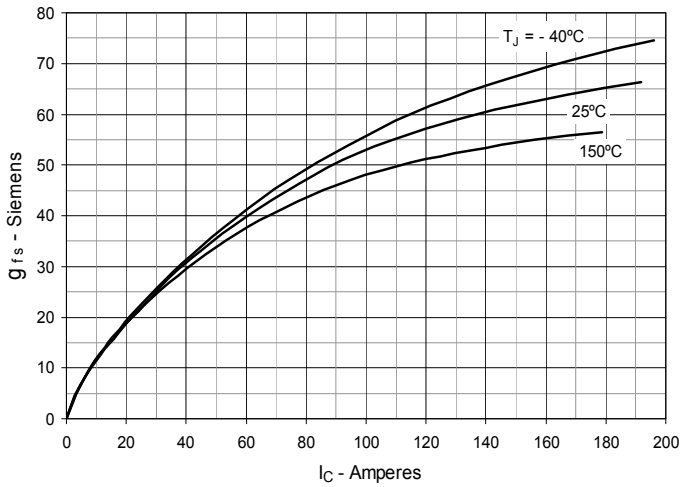
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (clamp),  $T_J$  or  $R_G$ .

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

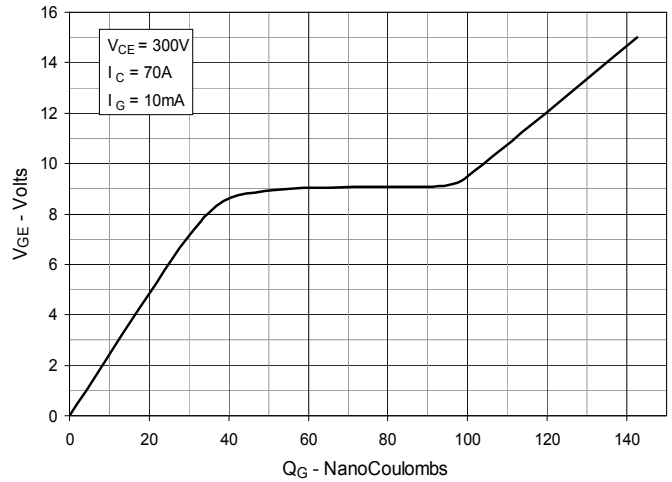
|  |           |           |           |           |              |              |              |              |              |             |
|--|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| IXYS MOSFETs and 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**


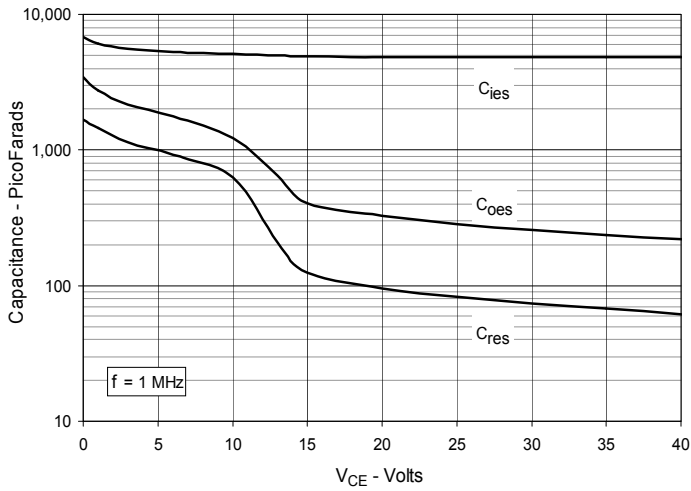
**Fig. 7. Transconductance**



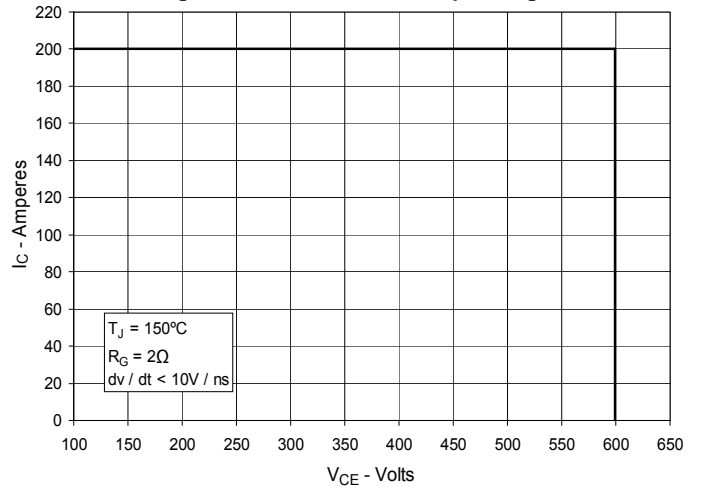
**Fig. 8. Gate Charge**



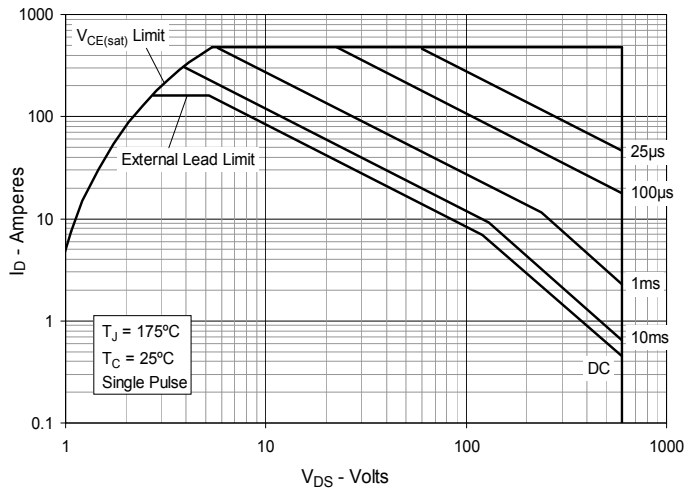
**Fig. 9. Capacitance**



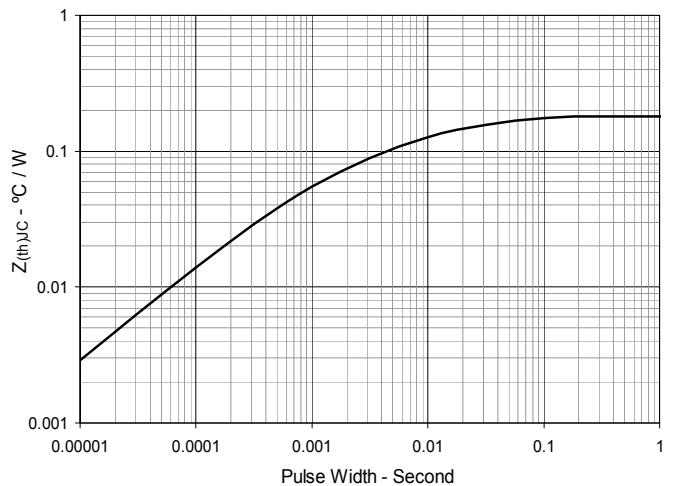
**Fig. 10. Reverse-Bias Safe Operating Area**

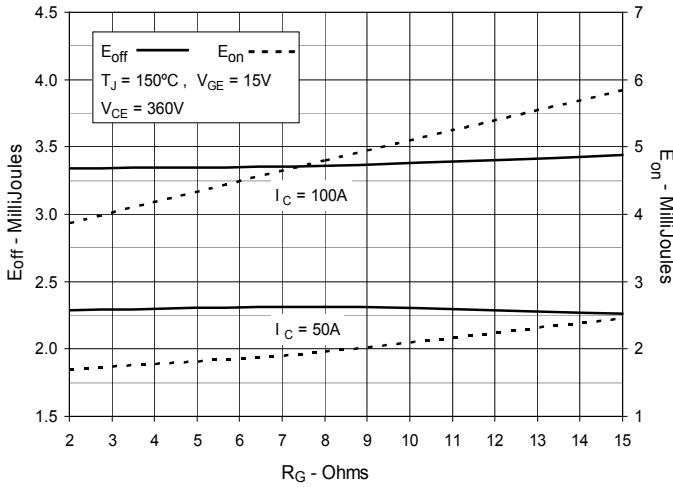
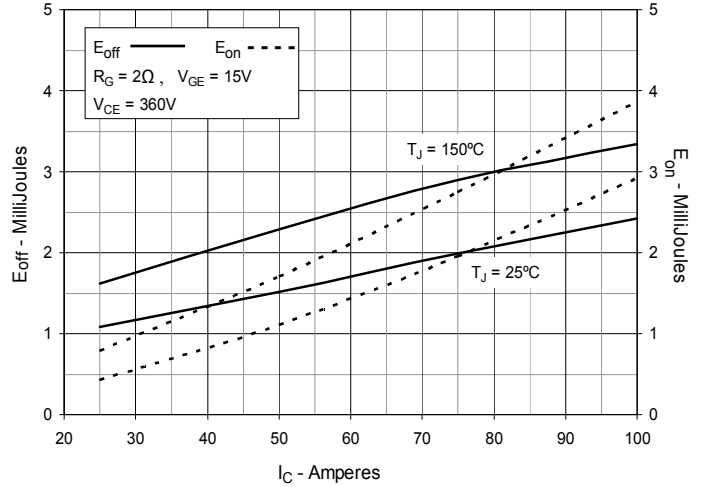
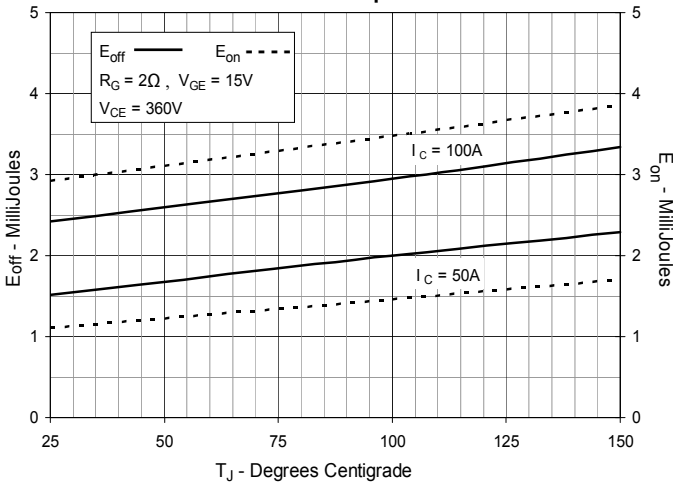
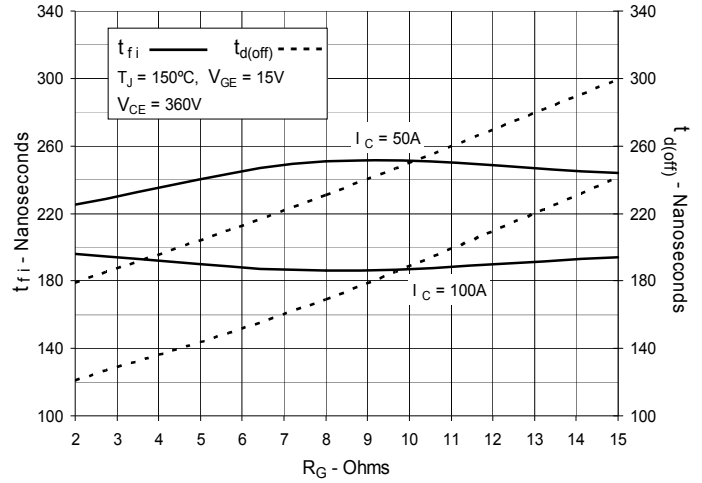
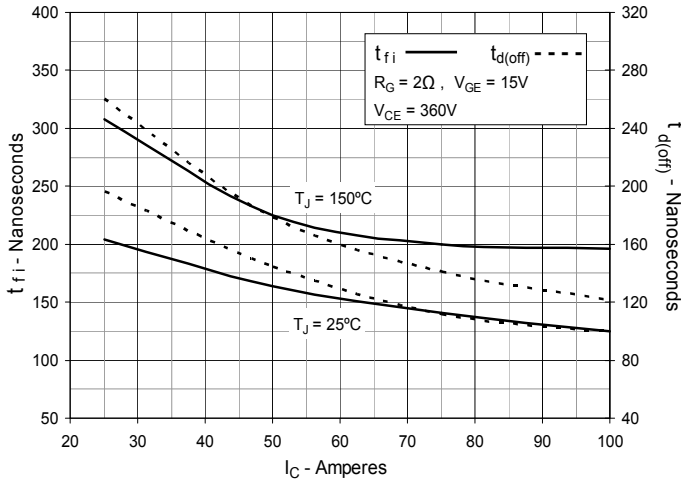


**Fig. 11. Forward-Bias Safe Operating Area**



**Fig. 12. Maximum Transient Thermal Impedance**



**Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance**

**Fig. 14. Inductive Switching Energy Loss vs. Collector Current**

**Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature**

**Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance**

**Fig. 17. Inductive Turn-off Switching Times vs. Collector Current**

**Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature**
