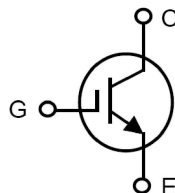


# XPT™ 650V IGBT GenX4™

# IXXH110N65B4

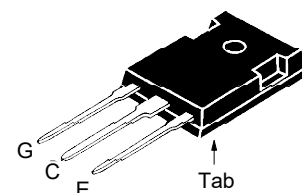
Extreme Light Punch Through  
IGBT for 10-30kHz Switching



$V_{CES} = 650V$   
 $I_{C110} = 110A$   
 $V_{CE(sat)} \leq 2.10V$   
 $t_{fi(typ)} = 43ns$

| Symbol                             | Test Conditions   | Maximum Ratings                         |            |
|------------------------------------|---|---|------------|
| $V_{CES}$                          | $T_J = 25^\circ C$ to $175^\circ C$   | 650                                     | V          |
| $V_{CGR}$                          | $T_J = 25^\circ C$ to $175^\circ C$ , $R_{GE} = 1M\Omega$                                   | 650                                     | V          |
| $V_{GES}$                          | Continuous  | $\pm 20$                                | V          |
| $V_{GEM}$                          | Transient   | $\pm 30$                                | V          |
| $I_{C25}$                          | $T_C = 25^\circ C$ (Chip Capability)  | 250                                     | A          |
| $I_{LRMS}$                         | Terminal Current Limit  | 160                                     | A          |
| $I_{C110}$                         | $T_C = 110^\circ C$   | 110                                     | A          |
| $I_{CM}$                           | $T_C = 25^\circ C$ , 1ms  | 570                                     | A          |
| <b>SSOA (RBSOA)</b>                | $V_{GE} = 15V$ , $T_{VJ} = 150^\circ C$ , $R_G = 2\Omega$<br>Clamped Inductive Load         | $I_{CM} = 220$<br>$V_{CE} \leq V_{CES}$ | A          |
| <b><math>t_{sc}</math> (SCSOA)</b> | $V_{GE} = 15V$ , $V_{CE} = 360V$ , $T_J = 150^\circ C$<br>$R_G = 82\Omega$ , Non Repetitive | 10                                      | $\mu s$    |
| $P_c$                              | $T_C = 25^\circ C$  | 880                                     | W          |
| $T_J$                              |   | -55 ... +175                            | $^\circ C$ |
| $T_{JM}$                           |   | 175                                     | $^\circ C$ |
| $T_{stg}$                          |   | -55 ... +175                            | $^\circ C$ |
| $T_L$                              | Maximum Lead Temperature for Soldering<br>1.6 mm (0.062 in.) from Case for 10s              | 300                                     | $^\circ C$ |
| $M_d$                              | Mounting Torque   | 1.13/10                                 | Nm/lb.in.  |
| <b>Weight</b>                      |   | 6                                       | g          |

## TO-247



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

## Features

- Optimized for 10-30kHz Switching
- Square RBSOA
- 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
- High Frequency Power Inverters

| Symbol        | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |                           |
|---------------|---|-----------------------|------|---------------------------|
|               |   | Min.                  | Typ. | Max.                      |
| $BV_{CES}$    | $I_C = 250\mu A$ , $V_{GE} = 0V$                                      | 650                   |      | V                         |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                                  | 4.0                   |      | 6.5 V                     |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 150^\circ C$             |                       |      | 10 $\mu A$<br>500 $\mu A$ |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |      | $\pm 100$ nA              |
| $V_{CE(sat)}$ | $I_C = 110A$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 150^\circ C$         | 1.72<br>2.05          |      | V<br>V                    |

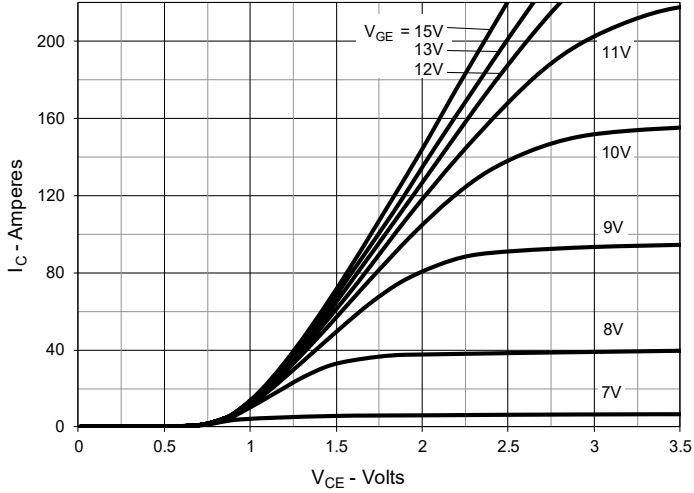
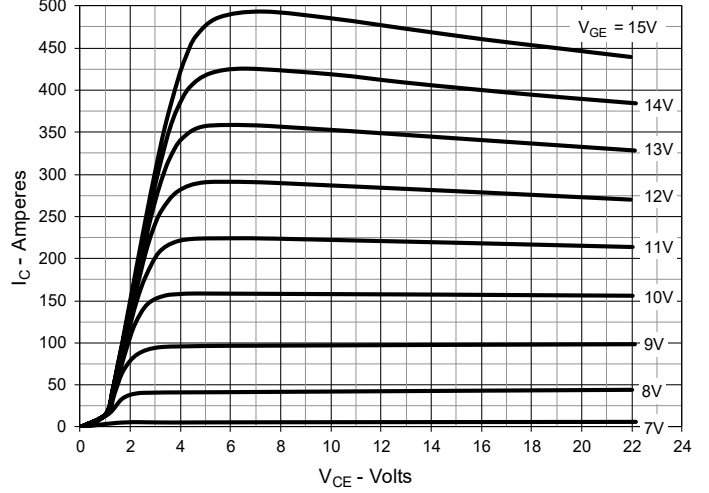
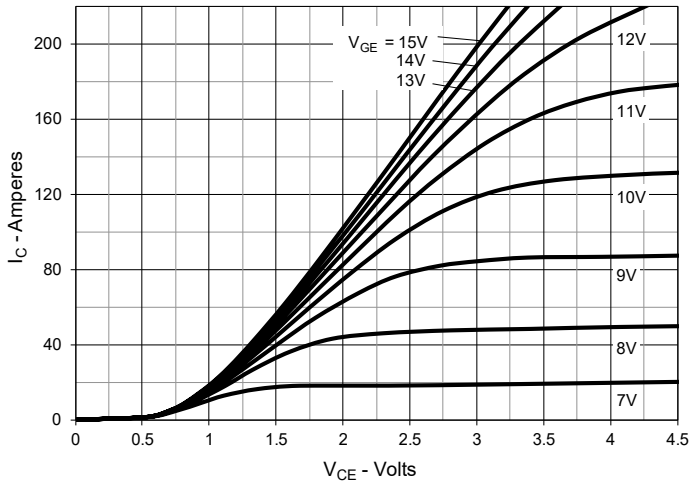
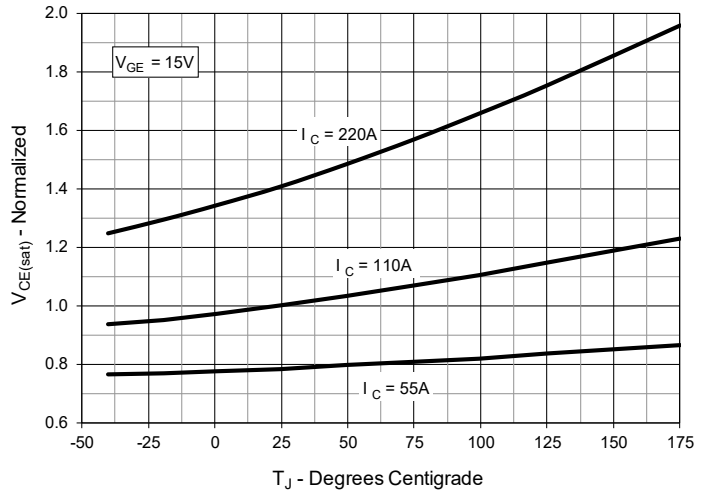
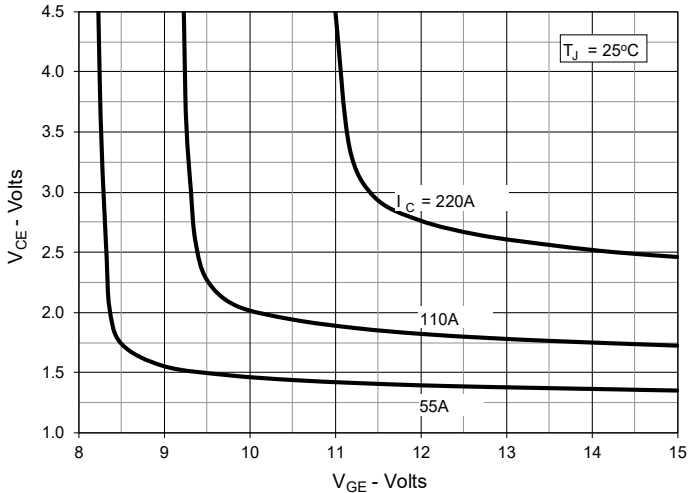
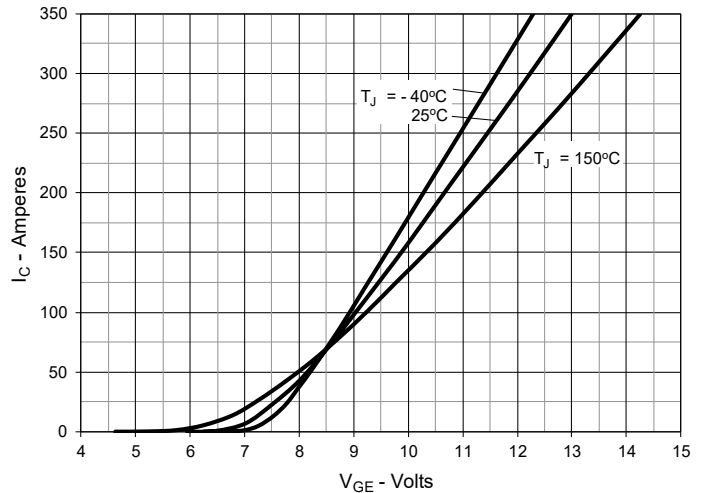
| Symbol Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) |   | Characteristic Values |      |                    |
|--|---|-----------------------|------|--------------------|
|  |   | Min.                  | Typ. | Max.               |
| $g_{fs}$   | $I_C = 60\text{A}, V_{CE} = 10\text{V}, \text{Note 1}$  | 30                    | 52   | S                  |
| $C_{ies}$  | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$  |                       | 5500 | pF                 |
| $C_{oes}$  |   |                       | 267  | pF                 |
| $C_{res}$  |   |                       | 80   | pF                 |
| $Q_{g(on)}$  | $I_C = 110\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$  |                       | 183  | nC                 |
| $Q_{ge}$   |   |                       | 32   | nC                 |
| $Q_{gc}$   |   |                       | 83   | nC                 |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 55\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}, R_G = 2\Omega$<br>Note 2  |                       | 26   | ns                 |
| $t_{ri}$   |   |                       | 40   | ns                 |
| $E_{on}$   |   |                       | 2.20 | mJ                 |
| $t_{d(off)}$   |   |                       | 146  | ns                 |
| $t_{fi}$   |   |                       | 43   | ns                 |
| $E_{off}$  |   |                       | 1.05 | 1.70 mJ            |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 150^\circ\text{C}</math></b><br>$I_C = 55\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 400\text{V}, R_G = 2\Omega$<br>Note 2 |                       | 25   | ns                 |
| $t_{ri}$   |   |                       | 40   | ns                 |
| $E_{on}$   |   |                       | 3.00 | mJ                 |
| $t_{d(off)}$   |   |                       | 140  | ns                 |
| $t_{fi}$   |   |                       | 110  | ns                 |
| $E_{off}$  |   |                       | 2.16 | mJ                 |
| $R_{thJC}$   |   |                       | 0.17 | $^\circ\text{C/W}$ |
| $R_{thCS}$   |   | 0.21                  |      | $^\circ\text{C/W}$ |

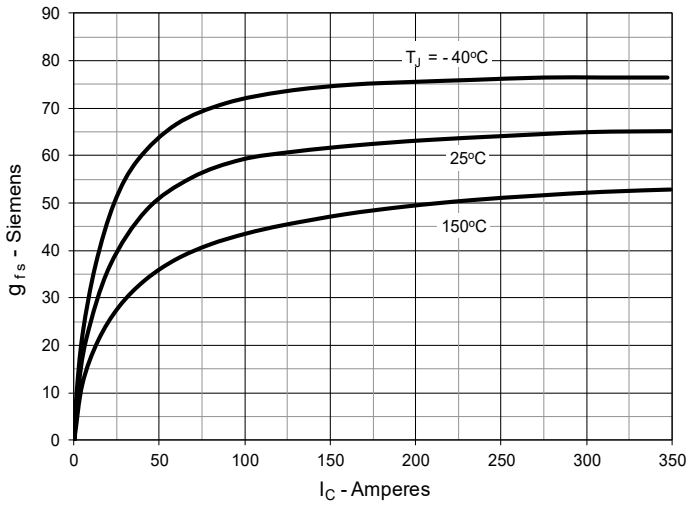
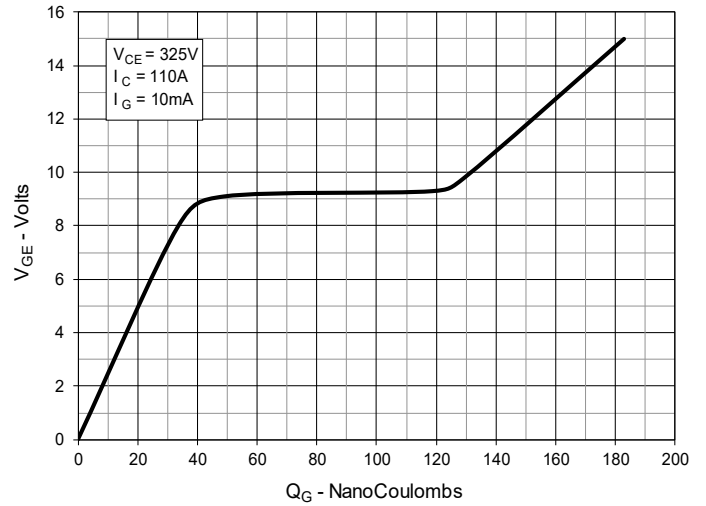
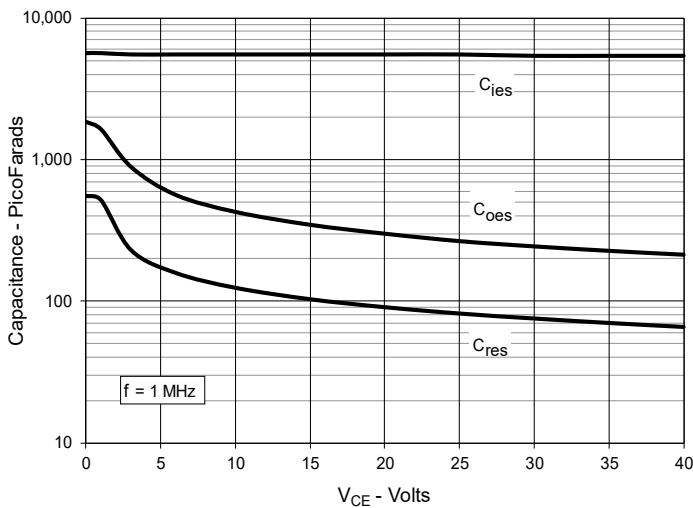
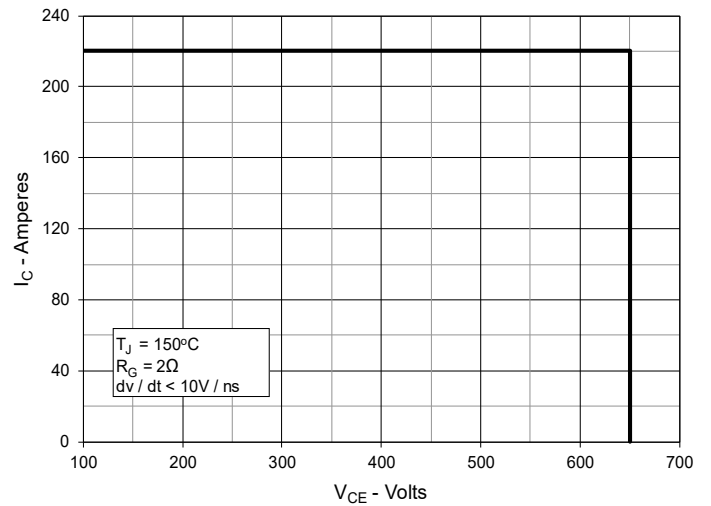
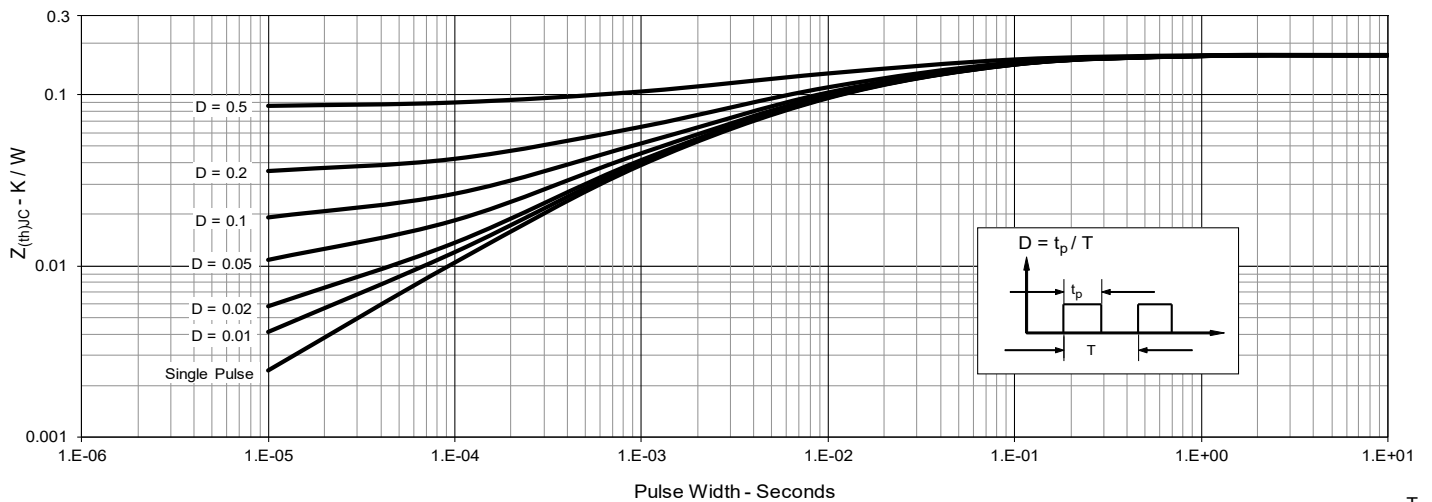
**Notes:**

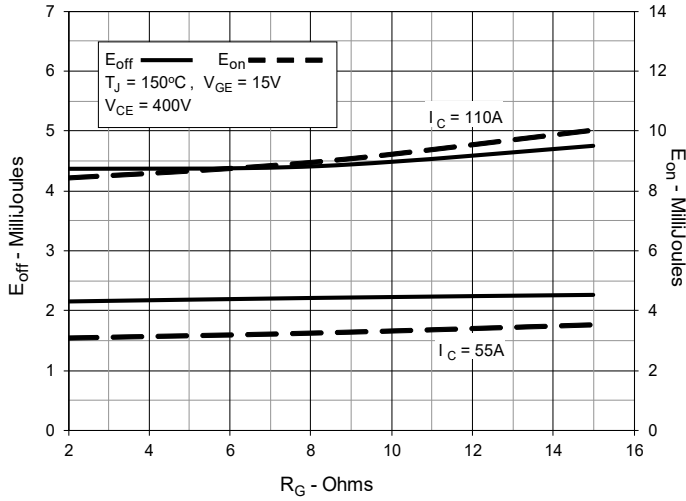
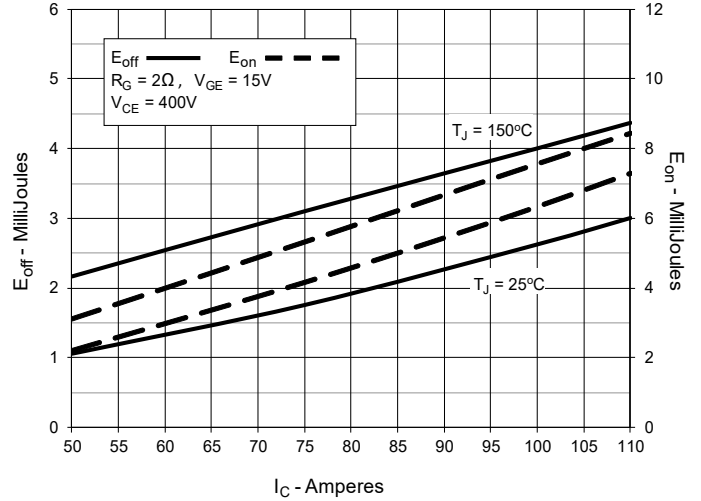
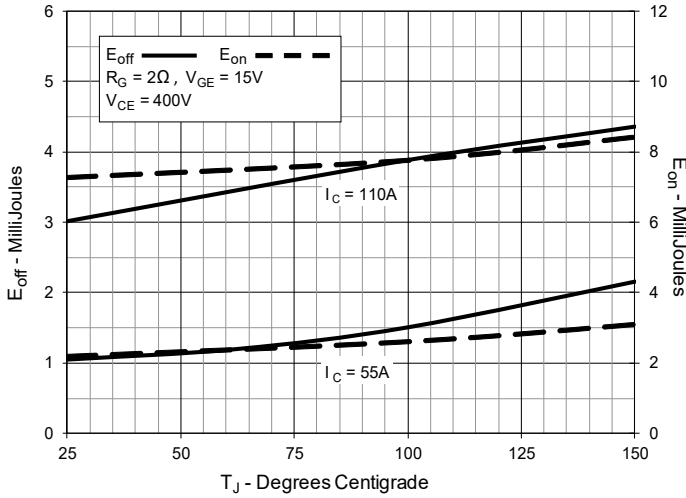
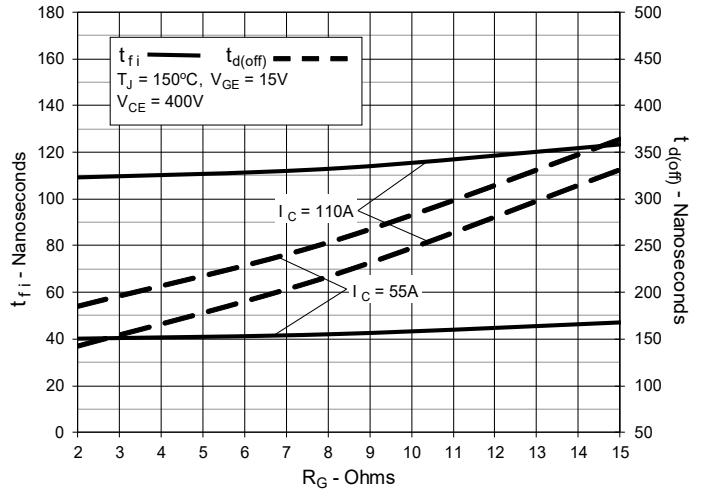
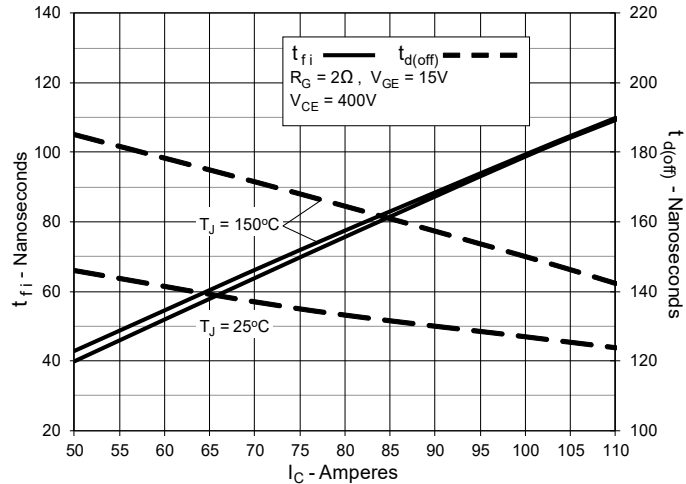
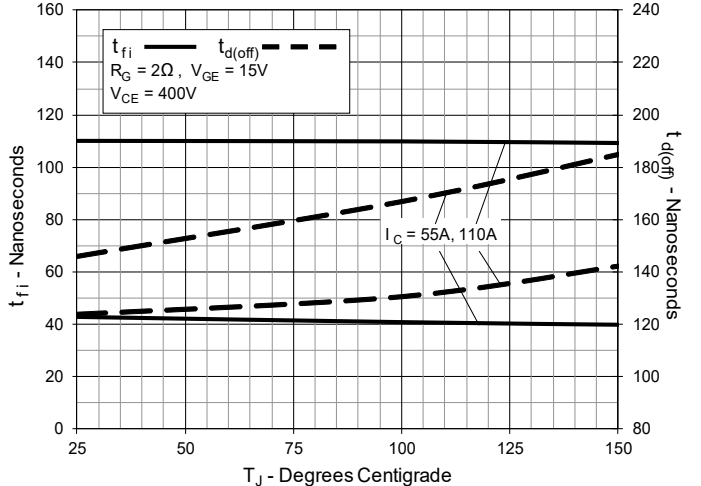
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (Clamp),  $T_J$  or  $R_G$ .

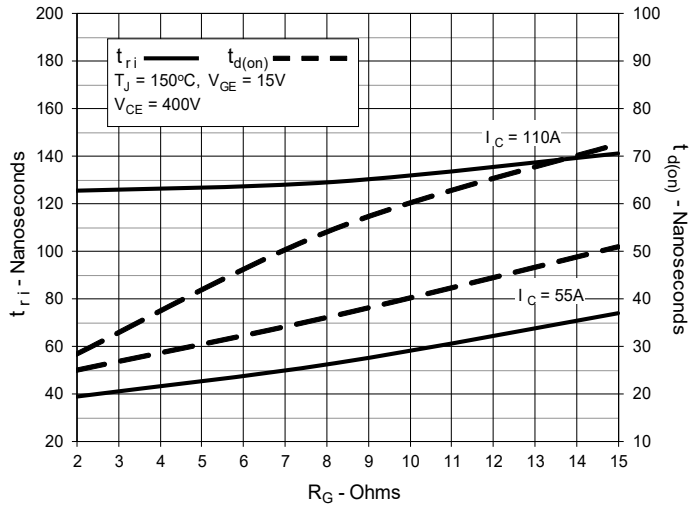
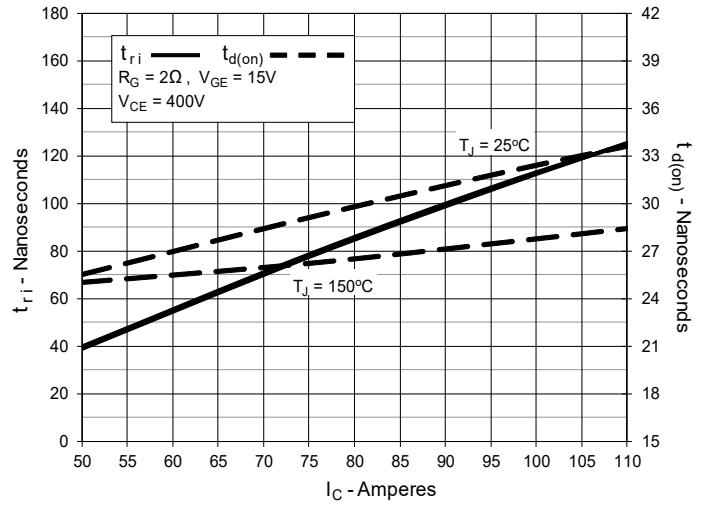
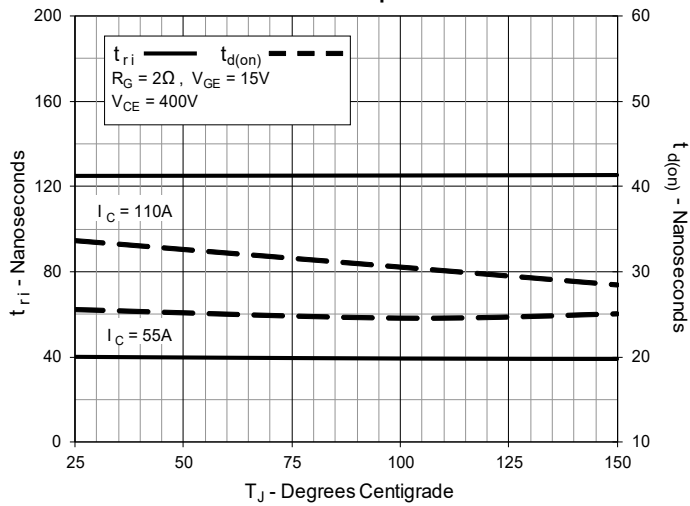
Littelfuse reserves the right to change limits, test conditions, and dimensions.

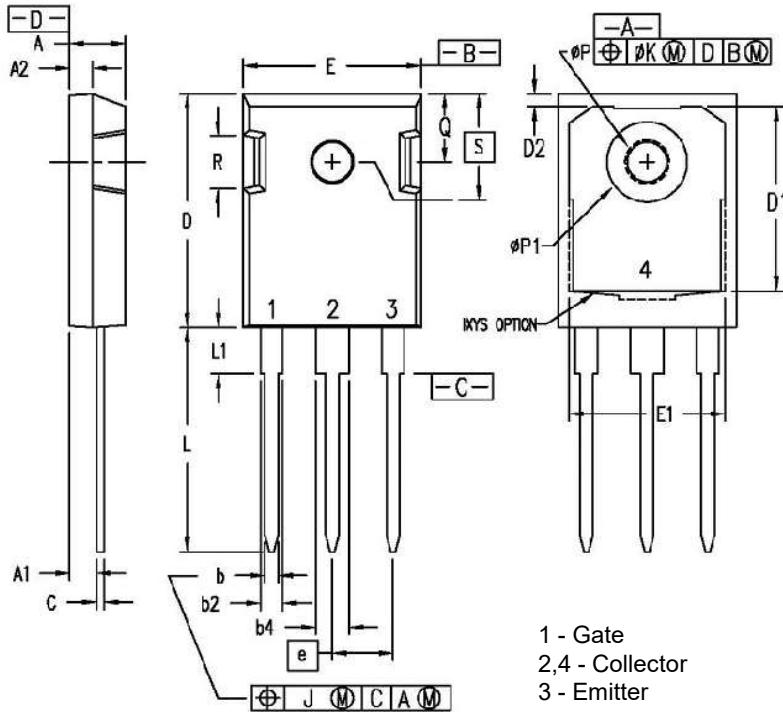
|   |           |           |           |           |              |              |              |              |              |             |
|---|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| IXYS MOSFETs and IGBTs are covered            | 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 |
| by one or more of the following U.S. patents: | 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**


**TO-247 (IXXH) 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  |
| b2  | .075     | .087 | 1.91        | 2.20  |
| b4  | .115     | .126 | 2.92        | 3.20  |
| C   | .024     | .031 | 0.61        | 0.80  |
| D   | .819     | .840 | 20.80       | 21.34 |
| D1  | .650     | .690 | 16.51       | 17.53 |
| D2  | .035     | .050 | 0.89        | 1.27  |
| E   | .620     | .635 | 15.75       | 16.13 |
| E1  | .545     | .565 | 13.84       | 14.35 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| J   | --       | .010 | --          | 0.25  |
| K   | --       | .025 | --          | 0.64  |
| L   | .780     | .810 | 19.81       | 20.57 |
| L1  | .150     | .170 | 3.81        | 4.32  |
| øP  | .140     | .144 | 3.55        | 3.65  |
| øP1 | .275     | .290 | 6.99        | 7.37  |
| Q   | .220     | .244 | 5.59        | 6.20  |
| R   | .170     | .190 | 4.32        | 4.83  |
| S   | .242 BSC |      | 6.15 BSC    |       |

NOTE: This drawing will meet all dimensions requirement of JEDEC outlines TO-247 AD (R-PSIP-F3)

