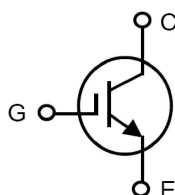


# 1200V XPT™ Gen 4 IGBT

## IXYK110N120B4

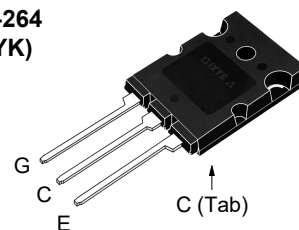
Extreme Light Punch Through  
IGBT for 5-30 kHz Switching



$$\begin{aligned} V_{CES} &= 1200V \\ I_{C110} &= 110A \\ V_{CE(sat)} &\leq 2.10V \\ t_{fi(typ)} &= 130ns \end{aligned}$$

| Symbol                        | Test Conditions                                                                     | Maximum Ratings                       |            |
|-------------------------------|-------------------------------------------------------------------------------------|---------------------------------------|------------|
| $V_{CES}$                     | $T_J = 25^\circ C$ to $175^\circ C$                                                 | 1200                                  | V          |
| $V_{CGR}$                     | $T_J = 25^\circ C$ to $175^\circ C$ , $R_{GE} = 1M\Omega$                           | 1200                                  | V          |
| $V_{GES}$                     | Continuous                                                                          | $\pm 20$                              | V          |
| $V_{GEM}$                     | Transient                                                                           | $\pm 30$                              | V          |
| $I_{C25}$                     | $T_C = 25^\circ C$ (Chip Capability)                                                | 340                                   | 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                                                            | 800                                   | A          |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 150^\circ C$ , $R_G = 2\Omega$<br>Clamped Inductive Load | $I_{CM} = 220$<br>$0.8 \cdot V_{CES}$ | A<br>V     |
| $P_C$                         | $T_C = 25^\circ C$                                                                  | 1360                                  | 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>                 |                                                                                     | 10                                    | g          |

TO-264  
(IXYK)



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

### Features

- Optimized for 5-30kHz Switching
- Positive Thermal Coefficient of  $V_{ce(sat)}$
- 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>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |              |                      |
|---------------|-----------------------------------------------------------------------|-----------------------|--------------|----------------------|
|               |                                                                       | Min.                  | Typ.         | Max.                 |
| $BV_{CES}$    | $I_C = 250\mu A$ , $V_{GE} = 0V$                                      | 1200                  |              | V                    |
| $V_{GE(th)}$  | $I_C = 3mA$ , $V_{CE} = V_{GE}$                                       | 4.5                   |              | 6.5 V                |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 150^\circ C$             |                       |              | 25 $\mu A$<br>1.5 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |              | $\pm 100$ nA         |
| $V_{CE(sat)}$ | $I_C = I_{C110}$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 150^\circ C$     |                       | 1.66<br>1.95 | 2.10 V<br>V          |

| Symbol Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) |                                                                                                                                                                 | Characteristic Values |      |                         |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|                                                                                  |                                                                                                                                                                 | Min.                  | Typ. | Max.                    |
| $g_{fs}$                                                                         | $I_C = 55\text{A}, V_{CE} = 10\text{V}, \text{Note 1}$                                                                                                          | 40                    | 68   | S                       |
| $C_{ies}$                                                                        | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                                      |                       | 5460 | pF                      |
| $C_{oes}$                                                                        |                                                                                                                                                                 |                       | 340  | pF                      |
| $C_{res}$                                                                        |                                                                                                                                                                 |                       | 220  | pF                      |
| $Q_{g(on)}$                                                                      | $I_C = I_{C110}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                                               |                       | 340  | nC                      |
| $Q_{ge}$                                                                         |                                                                                                                                                                 |                       | 52   | nC                      |
| $Q_{gc}$                                                                         |                                                                                                                                                                 |                       | 144  | 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>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 2\Omega$<br>Note 2  |                       | 45   | ns                      |
| $t_{ri}$                                                                         |                                                                                                                                                                 |                       | 50   | ns                      |
| $E_{on}$                                                                         |                                                                                                                                                                 |                       | 3.60 | mJ                      |
| $t_{d(off)}$                                                                     |                                                                                                                                                                 |                       | 390  | ns                      |
| $t_{fi}$                                                                         |                                                                                                                                                                 |                       | 130  | ns                      |
| $E_{off}$                                                                        |                                                                                                                                                                 |                       | 3.85 | 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>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 2\Omega$<br>Note 2 |                       | 34   | ns                      |
| $t_{ri}$                                                                         |                                                                                                                                                                 |                       | 38   | ns                      |
| $E_{on}$                                                                         |                                                                                                                                                                 |                       | 4.96 | mJ                      |
| $t_{d(off)}$                                                                     |                                                                                                                                                                 |                       | 440  | ns                      |
| $t_{fi}$                                                                         |                                                                                                                                                                 |                       | 210  | ns                      |
| $E_{off}$                                                                        |                                                                                                                                                                 |                       | 6.45 | mJ                      |
| $R_{thJC}$                                                                       |                                                                                                                                                                 |                       |      | 0.11 $^\circ\text{C/W}$ |
| $R_{thCS}$                                                                       |                                                                                                                                                                 |                       | 0.15 | $^\circ\text{C/W}$      |

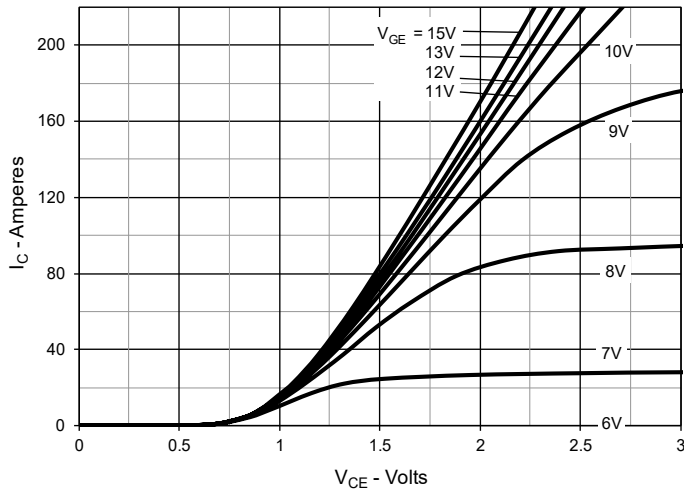
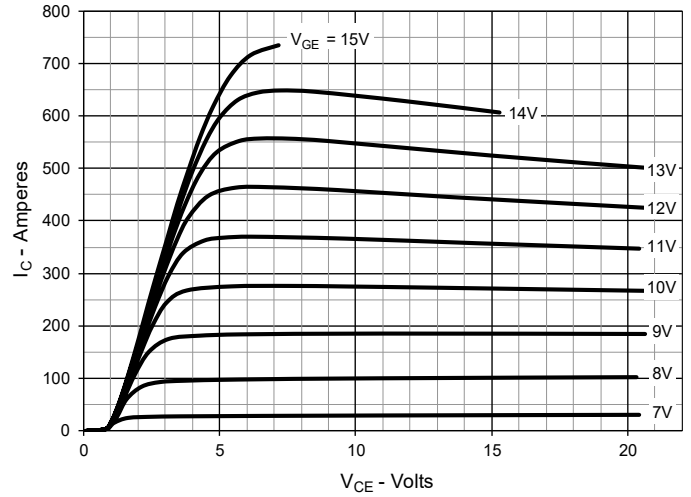
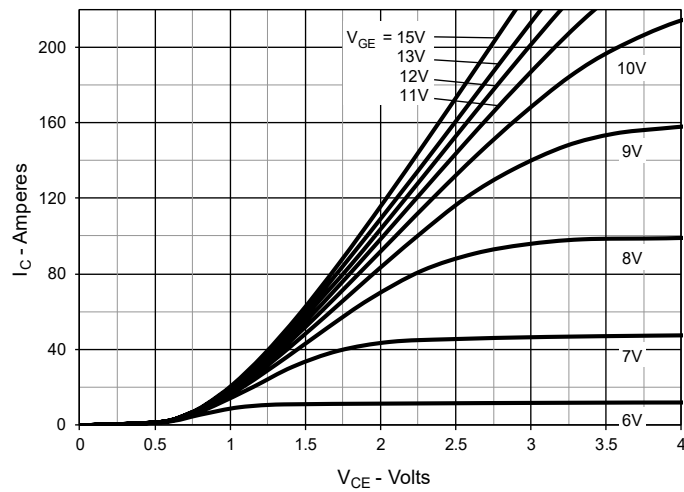
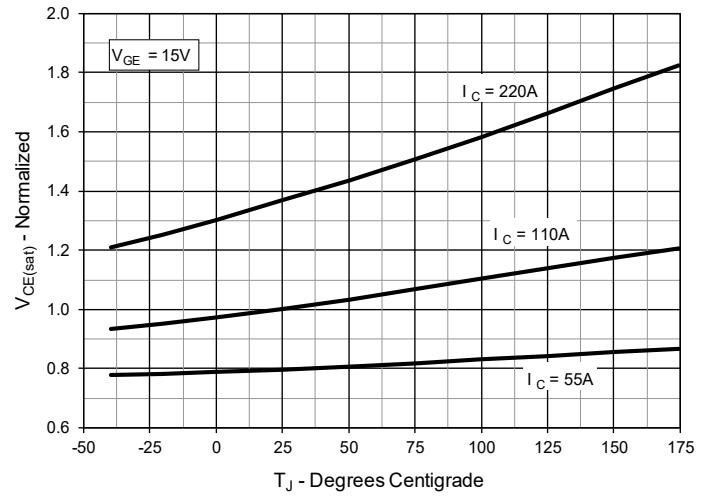
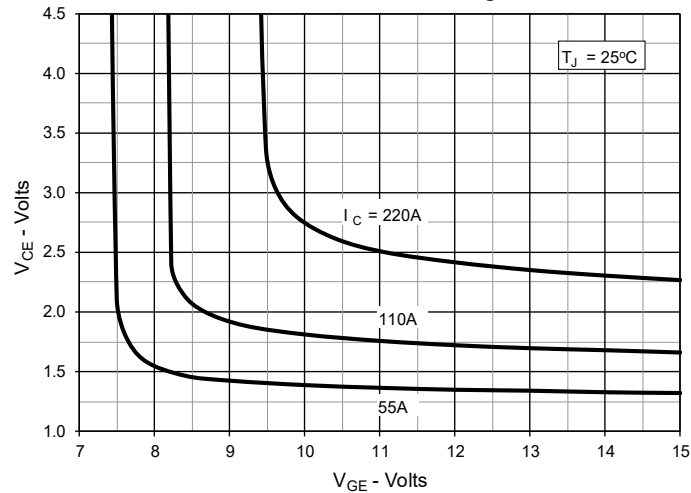
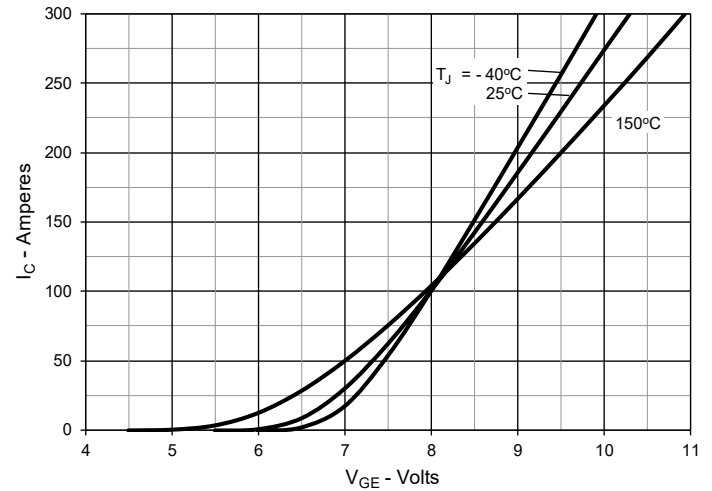
**Notes:**

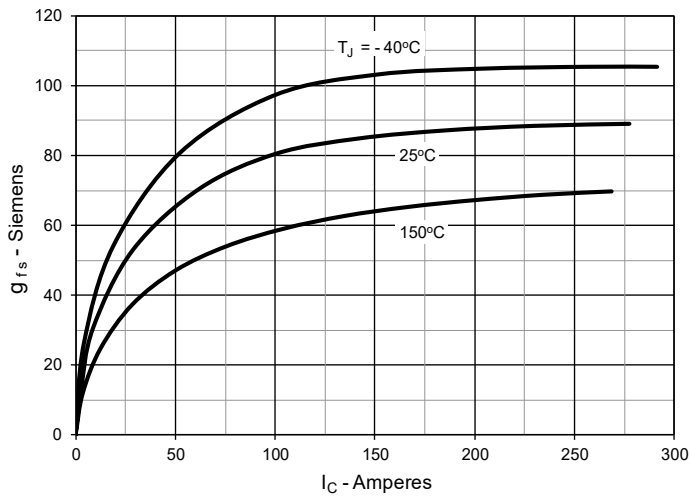
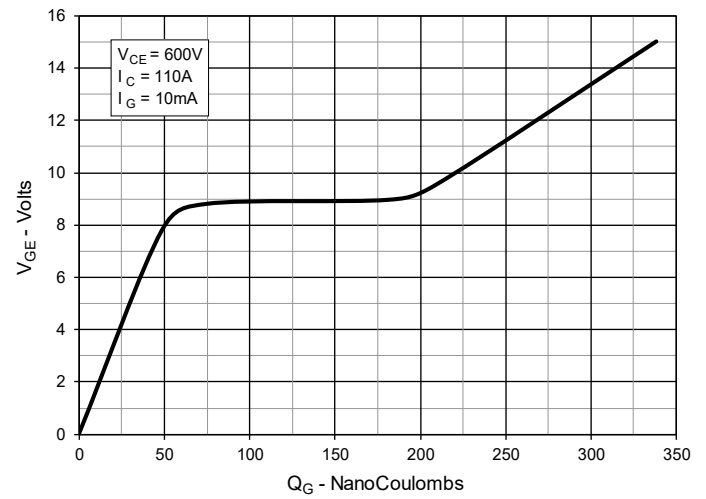
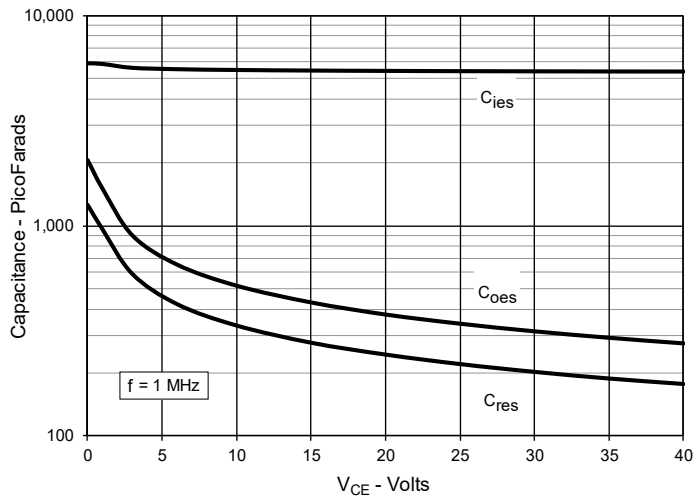
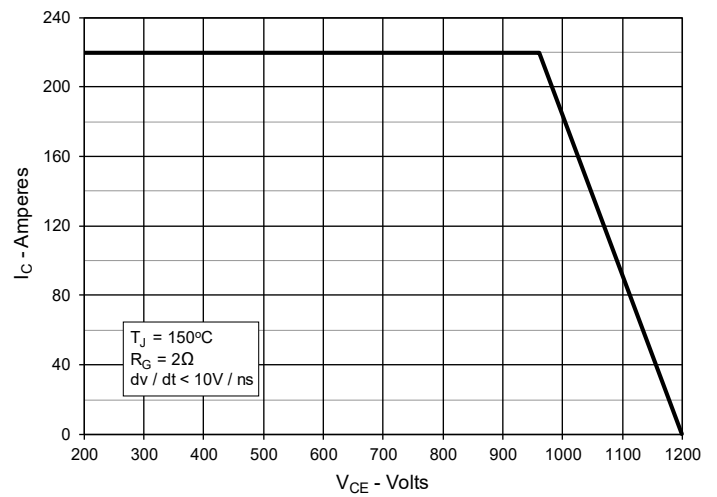
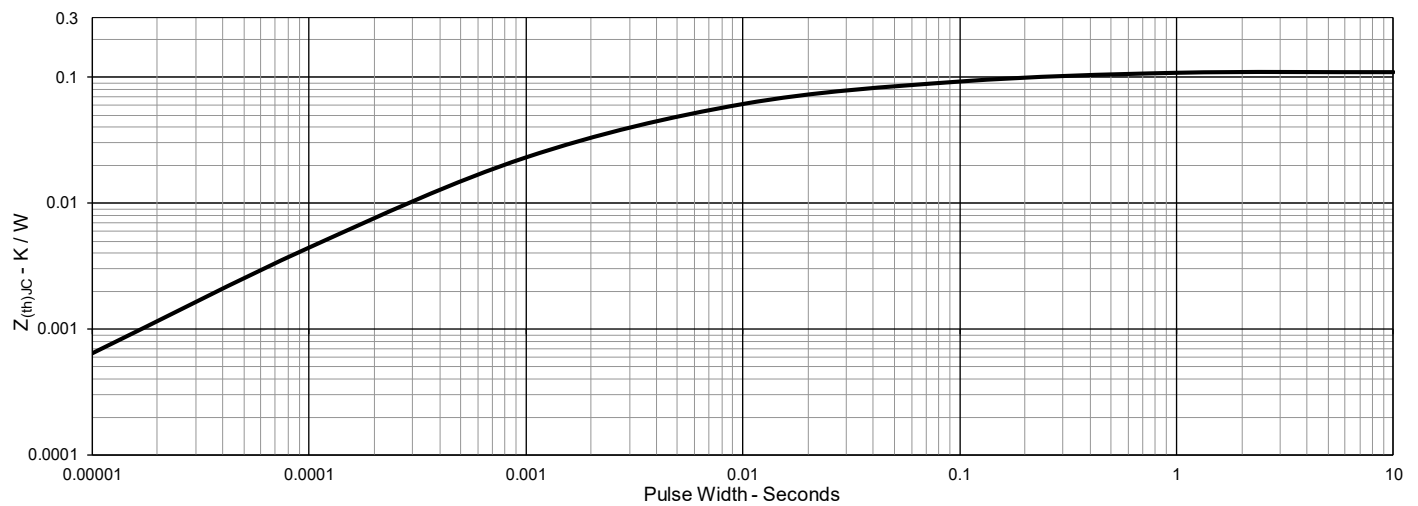
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}(\text{clamp})$ ,  $T_J$  or  $R_G$ .

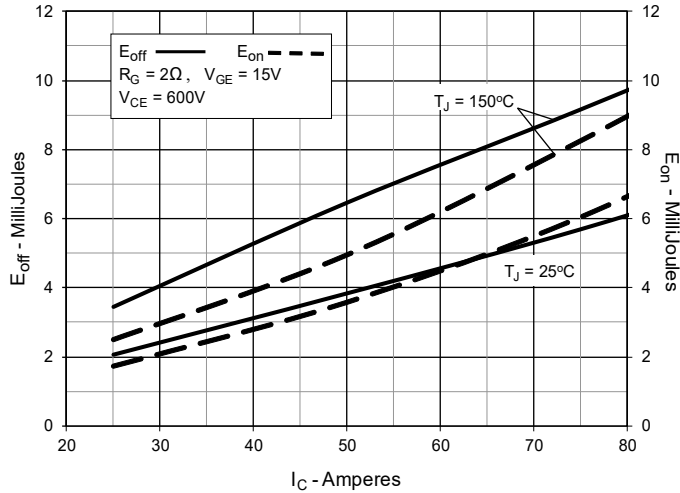
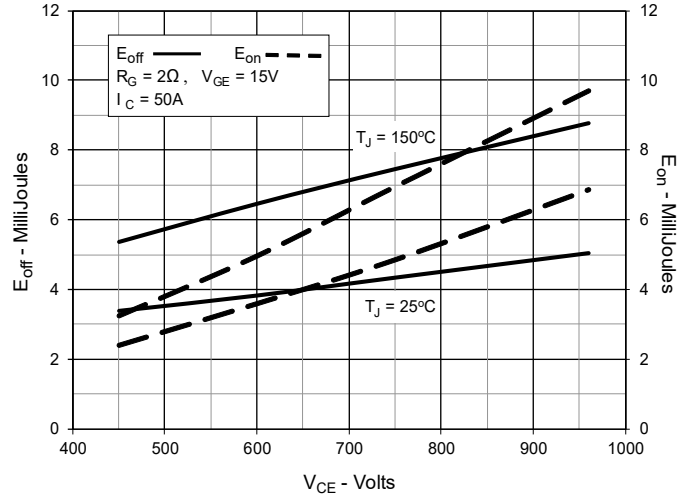
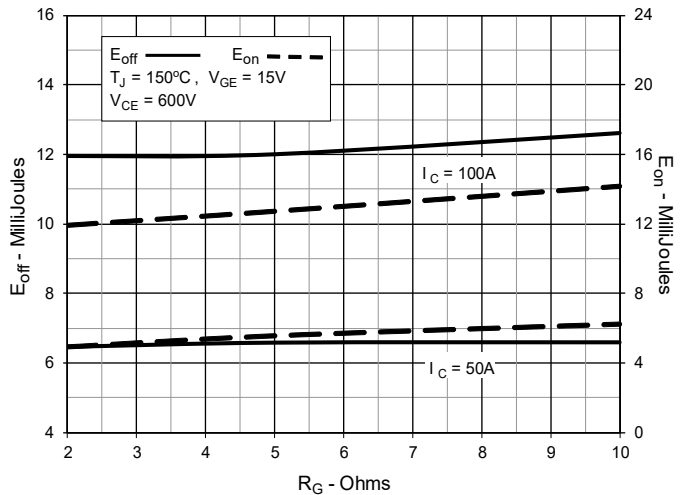
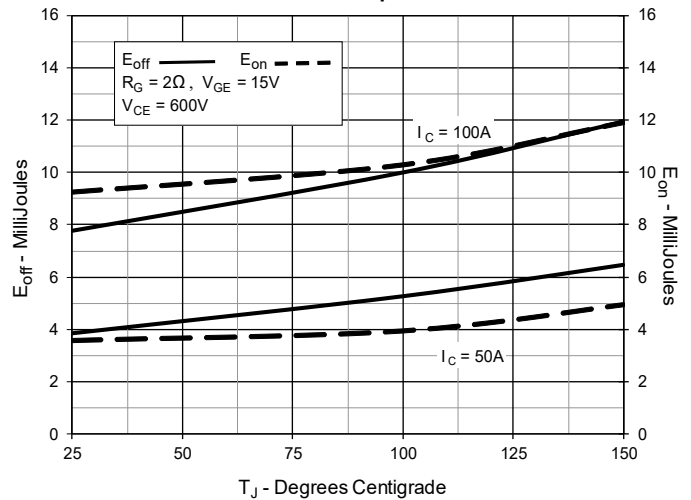
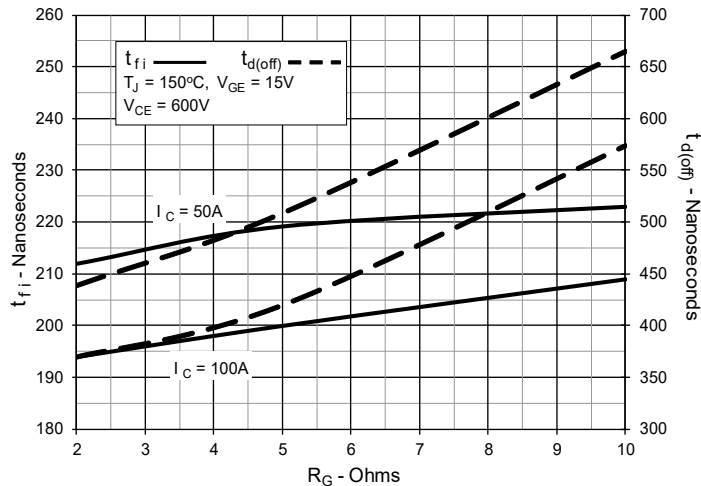
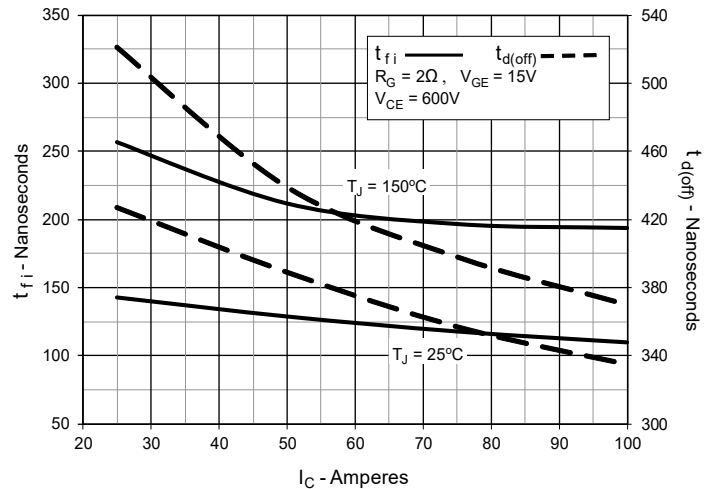
Littelfuse reserves the right to change limits, test conditions, and dimensions.

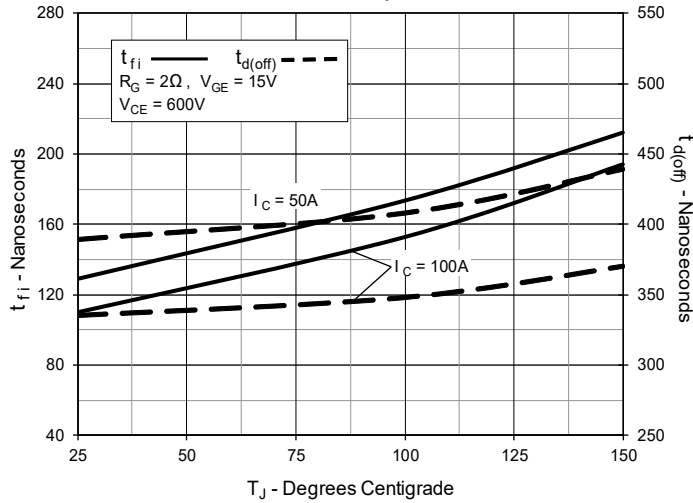
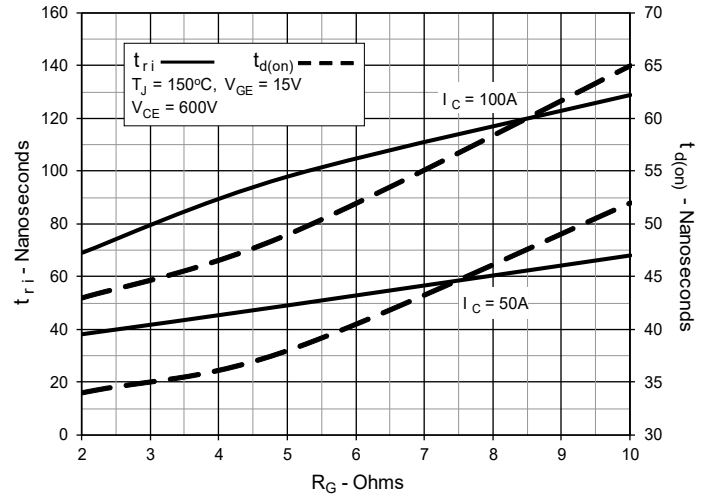
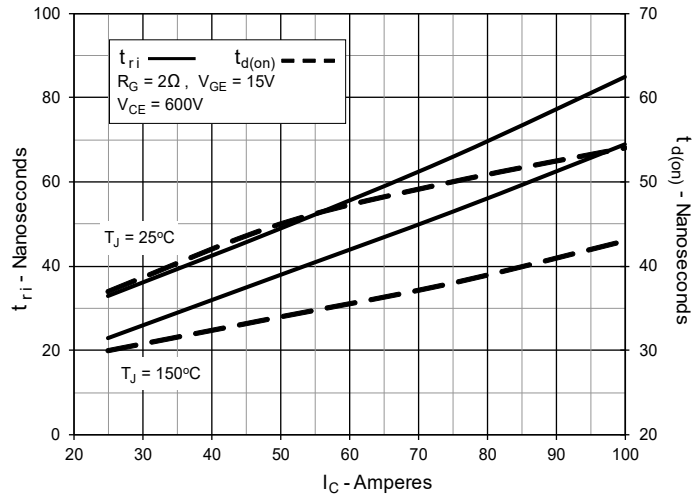
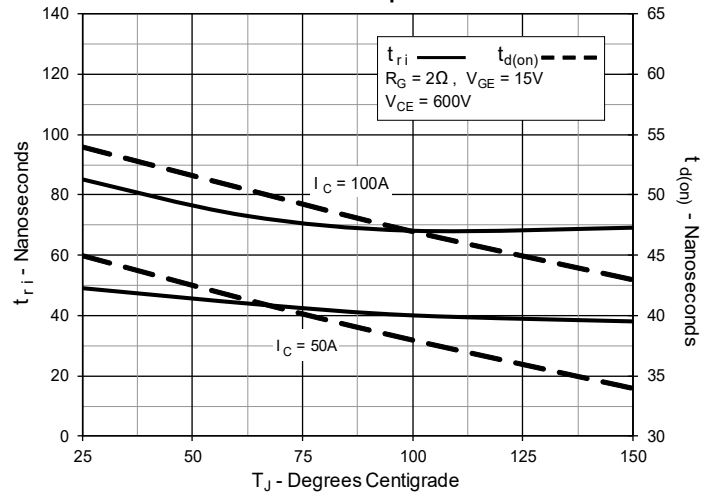
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

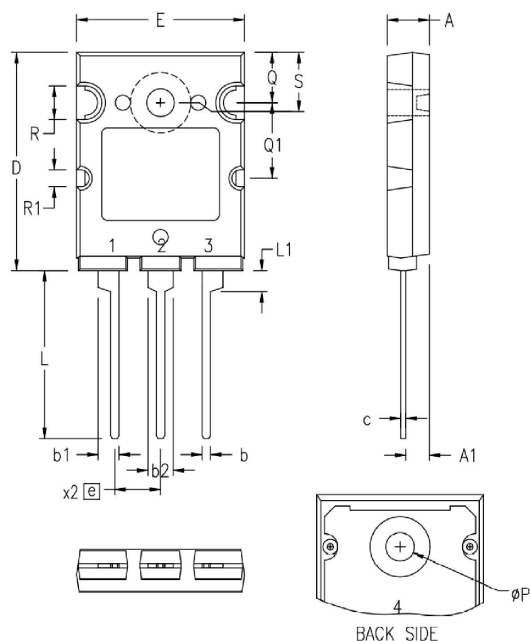
|           |           |           |           |              |              |              |              |              |             |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 4,835,592 | 4,931,844 | 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. Collector Current**

**Fig. 13. Inductive Switching Energy Loss vs. Collector-Emitter Voltage**

**Fig. 14. Inductive Switching Energy Loss vs. Gate Resistance**

**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**

**Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance**

**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**

**Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature**


**TO-264 Outline**


**1 - Gate**  
**2,4 - Collector**  
**3 - Emitter**

| SYM | INCHES  |       | MILLIMETERS |       |
|-----|---------|-------|-------------|-------|
|     | MIN     | MAX   | MIN         | MAX   |
| A   | .185    | .209  | 4.70        | 5.30  |
| A1  | .102    | .118  | 2.60        | 3.00  |
| b   | .035    | .049  | 0.90        | 1.25  |
| b1  | .091    | .106  | 2.30        | 2.70  |
| b2  | .110    | .126  | 2.80        | 3.20  |
| c   | .020    | .033  | 0.50        | 0.85  |
| D   | 1.012   | 1.035 | 25.70       | 26.30 |
| E   | .776    | .799  | 19.70       | 20.30 |
| e   | .215BSC |       | 5.46 BSC    |       |
| L   | .768    | .807  | 19.50       | 20.50 |
| L1  | .091    | .106  | 2.30        | 2.70  |
| øP  | .122    | .138  | 3.10        | 3.50  |
| Q   | .228    | .244  | 5.80        | 6.20  |
| Q1  | .346    | .362  | 8.80        | 9.20  |
| øR  | .150    | .165  | 3.80        | 4.20  |
| øR1 | .071    | .087  | 1.80        | 2.20  |
| S   | .228    | .244  | 5.80        | 6.20  |