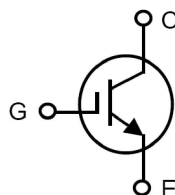


# 1200V XPT™ IGBT GenX4™

## IXYX140N120A4

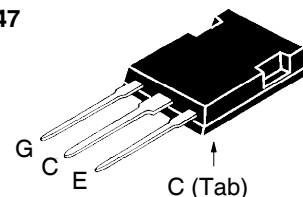
Ultra Low-V<sub>sat</sub> IGBT for  
up to 5kHz Switching



$$\begin{aligned} V_{CES} &= 1200V \\ I_{C110} &= 140A \\ V_{CE(sat)} &\leq 1.70V \\ t_{fi(typ)} &= 320ns \end{aligned}$$

| 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)                                           | 480                 | A          |
| $I_{LRMS}$     | Terminal Current Limit                                                         | 160                 | A          |
| $I_{C110}$     | $T_C = 110^\circ C$                                                            | 140                 | A          |
| $I_{CM}$       | $T_C = 25^\circ C$ , 1ms                                                       | 1200                | A          |
| <b>SSOA</b>    | $V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 2\Omega$                      | $I_{CM} = 280$      | A          |
| <b>(RBSOA)</b> | Clamped Inductive Load                                                         | $0.8 \cdot V_{CES}$ | V          |
| $P_C$          | $T_C = 25^\circ C$                                                             | 1500                | 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                 | $^\circ C$ |
| $F_C$          | Mounting Force                                                                 | 20..120 /4.5..27    | N/lb       |
| <b>Weight</b>  |                                                                                | 6                   | g          |

### PLUS247 (IXYX)



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

### Features

- Optimized for Low Conduction Losses
- 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
- Inrush Current Protection Circuits

| 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                  |
| $V_{GE(th)}$  | $I_C = 4mA$ , $V_{CE} = V_{GE}$                                       | 4.5                   |              | 6.5 V              |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 125^\circ C$             |                       |              | 25 $\mu A$<br>5 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |              | $\pm 200$ nA       |
| $V_{CE(sat)}$ | $I_C = I_{C110}$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 150^\circ C$     |                       | 1.34<br>1.50 | 1.70 V<br>V        |

| Symbol Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) |                                                                                                                                                                   | Characteristic Values |      |                         |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|                                                                                  |                                                                                                                                                                   | Min.                  | Typ. | Max.                    |
| $g_{fs}$                                                                         | $I_C = 60\text{A}, V_{CE} = 10\text{V}, \text{Note 1}$                                                                                                            | 60                    | 100  | S                       |
| $C_{ies}$                                                                        | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                                        |                       | 8300 | pF                      |
| $C_{oes}$                                                                        |                                                                                                                                                                   |                       | 470  | pF                      |
| $C_{res}$                                                                        |                                                                                                                                                                   |                       | 300  | pF                      |
| $Q_{g(on)}$                                                                      | $I_C = I_{C110}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                                                 |                       | 420  | nC                      |
| $Q_{ge}$                                                                         |                                                                                                                                                                   |                       | 68   | nC                      |
| $Q_{gc}$                                                                         |                                                                                                                                                                   |                       | 210  | 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>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 1.5\Omega$<br>Note 2  |                       | 52   | ns                      |
| $t_{ri}$                                                                         |                                                                                                                                                                   |                       | 47   | ns                      |
| $E_{on}$                                                                         |                                                                                                                                                                   |                       | 4.9  | mJ                      |
| $t_{d(off)}$                                                                     |                                                                                                                                                                   |                       | 590  | ns                      |
| $t_{fi}$                                                                         |                                                                                                                                                                   |                       | 320  | ns                      |
| $E_{off}$                                                                        |                                                                                                                                                                   |                       | 12.0 | 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>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 1.5\Omega$<br>Note 2 |                       | 44   | ns                      |
| $t_{ri}$                                                                         |                                                                                                                                                                   |                       | 42   | ns                      |
| $E_{on}$                                                                         |                                                                                                                                                                   |                       | 7.4  | mJ                      |
| $t_{d(off)}$                                                                     |                                                                                                                                                                   |                       | 710  | ns                      |
| $t_{fi}$                                                                         |                                                                                                                                                                   |                       | 530  | ns                      |
| $E_{off}$                                                                        |                                                                                                                                                                   |                       | 20.0 | mJ                      |
| $R_{thJC}$                                                                       |                                                                                                                                                                   |                       |      | 0.10 $^\circ\text{C/W}$ |
| $R_{thCS}$                                                                       |                                                                                                                                                                   | 0.15                  |      | $^\circ\text{C/W}$      |

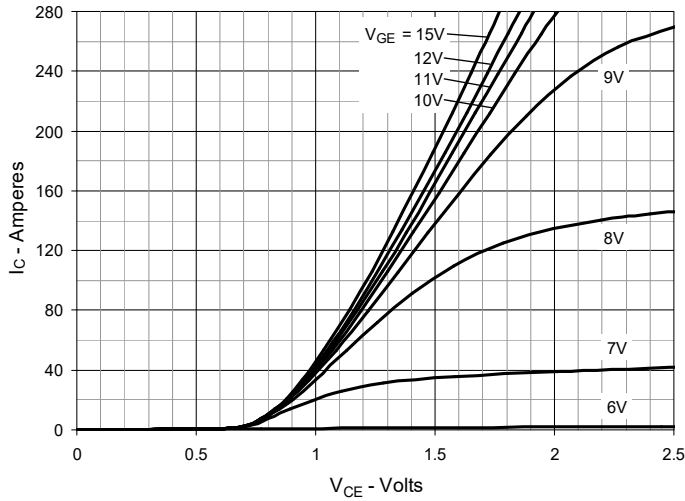
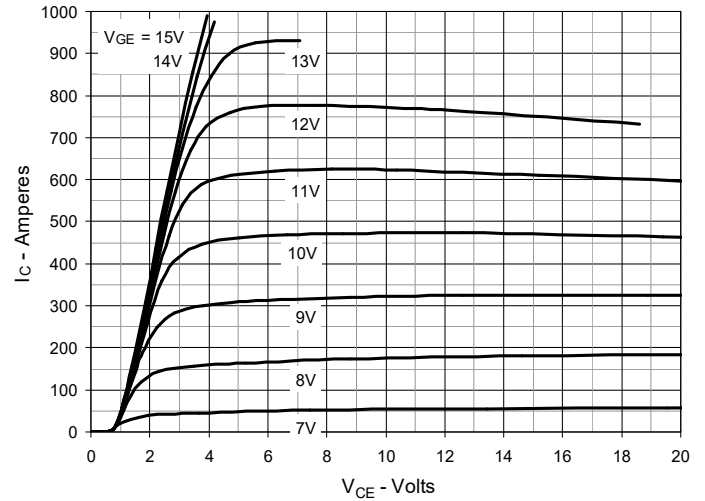
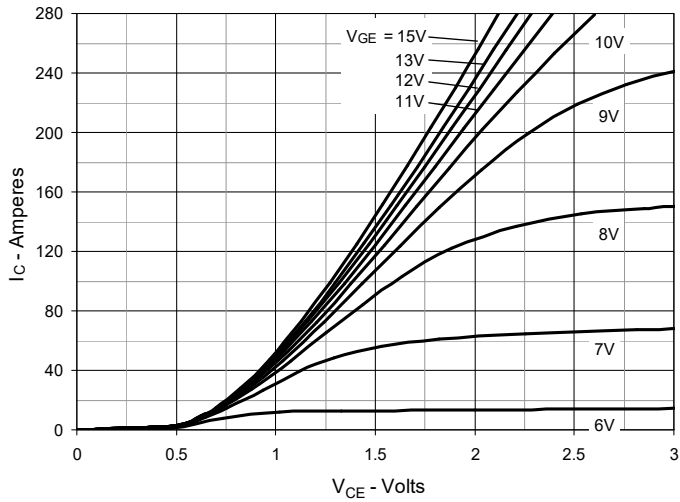
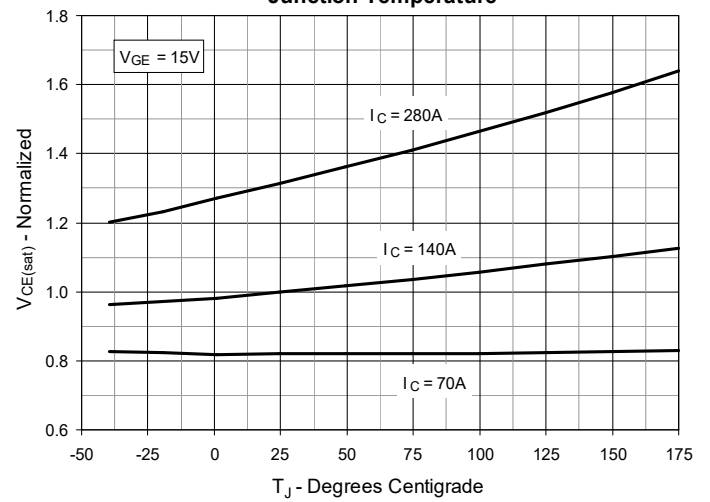
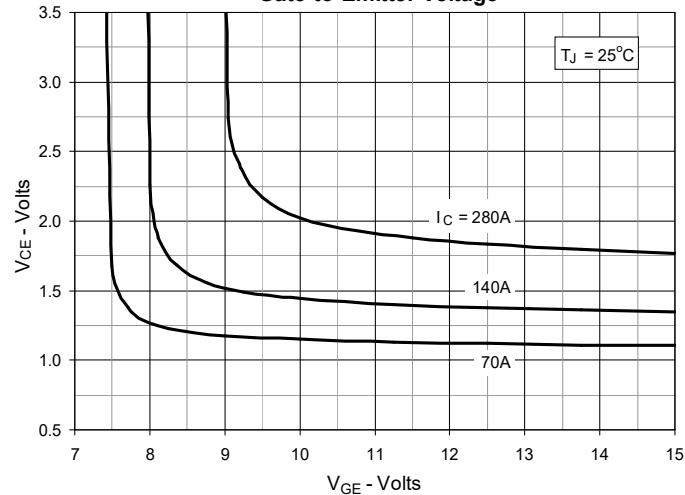
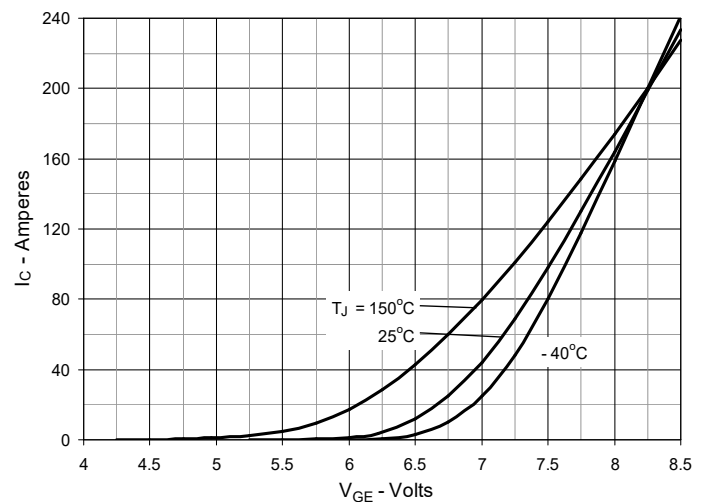
## Notes:

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  $R_G$ .

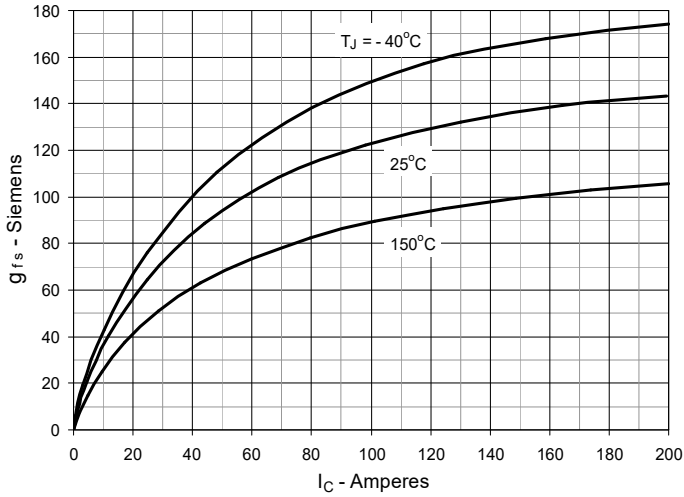
Littelfuse reserves the right to change limits, test conditions and dimensions.

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

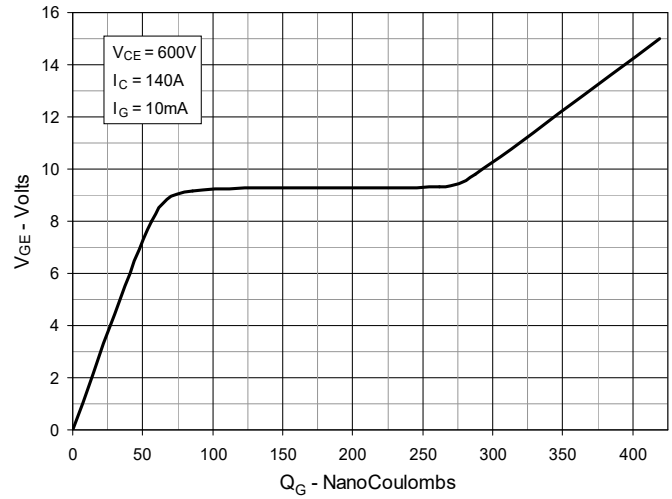
|           |           |           |           |              |              |              |              |              |             |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 4,835,592 | 4,931,844 | 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**


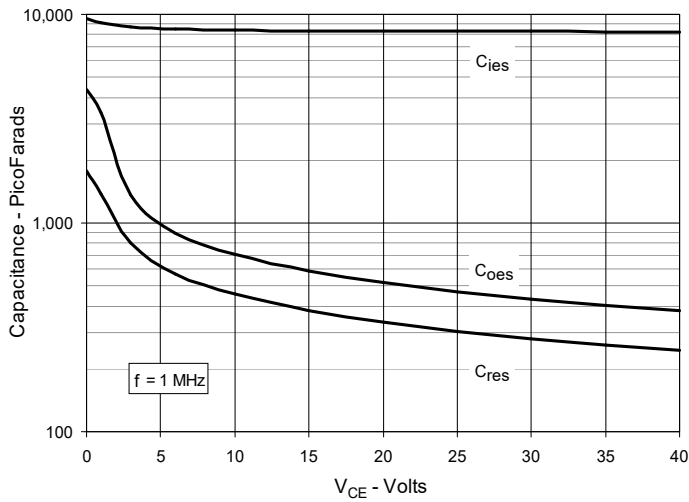
**Fig. 7. Transconductance**



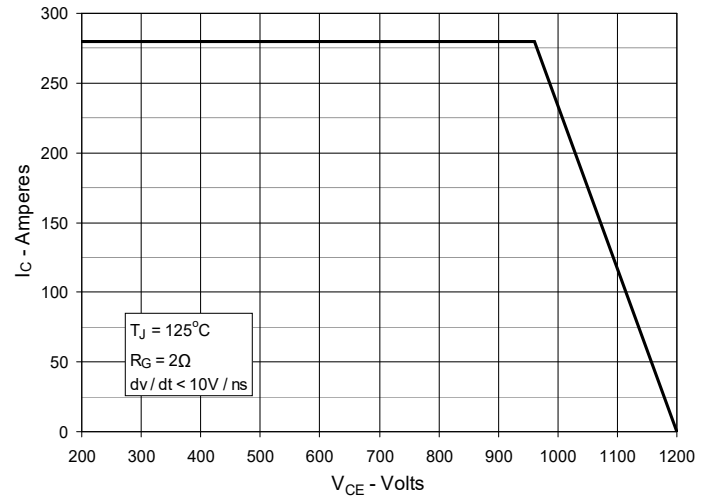
**Fig. 8. Gate Charge**



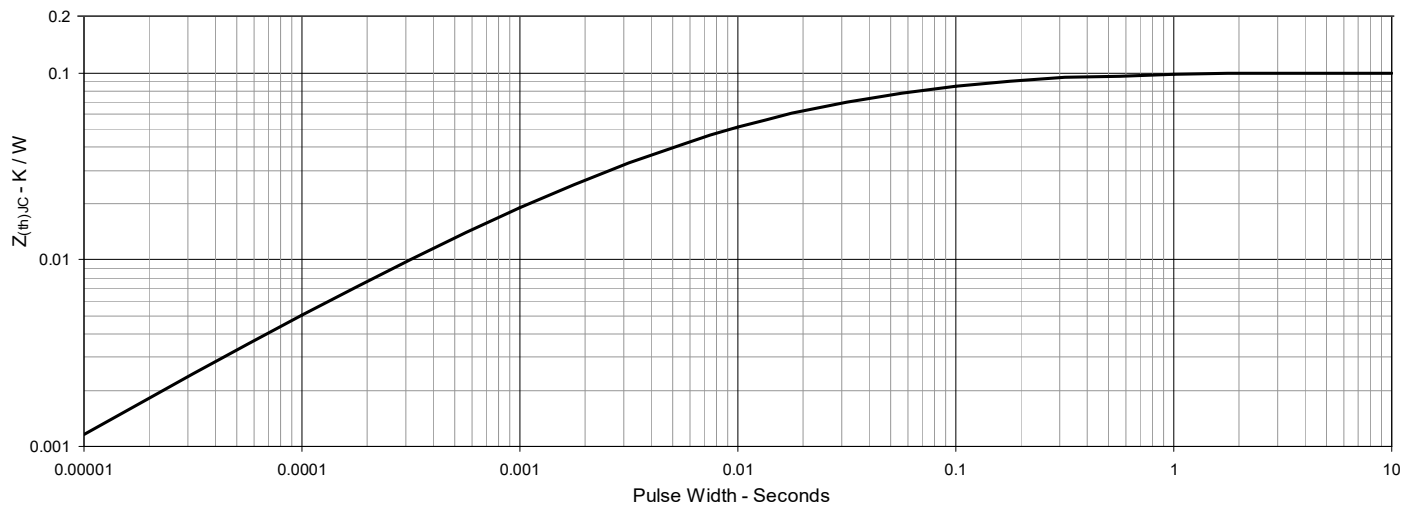
**Fig. 9. Capacitance**



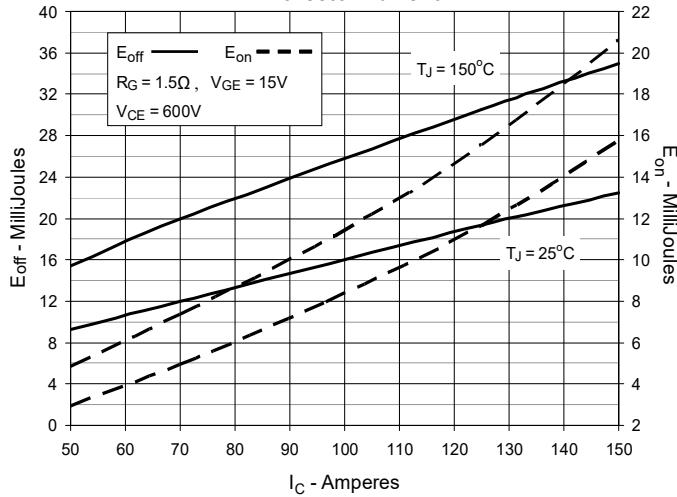
**Fig. 10. Reverse-Bias Safe Operating Area**



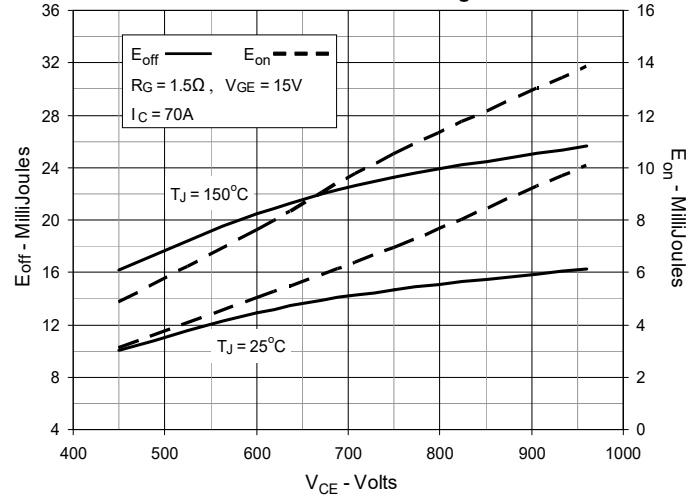
**Fig. 11. Maximum Transient Thermal Impedance**



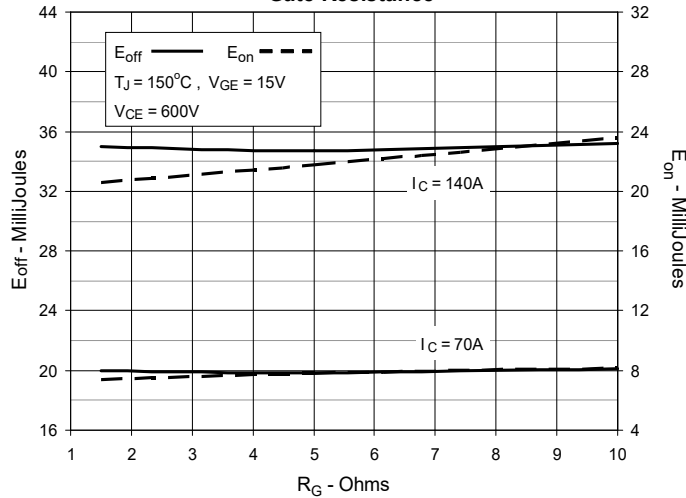
**Fig. 12. Inductive Switching Energy Loss vs. Collector Current**



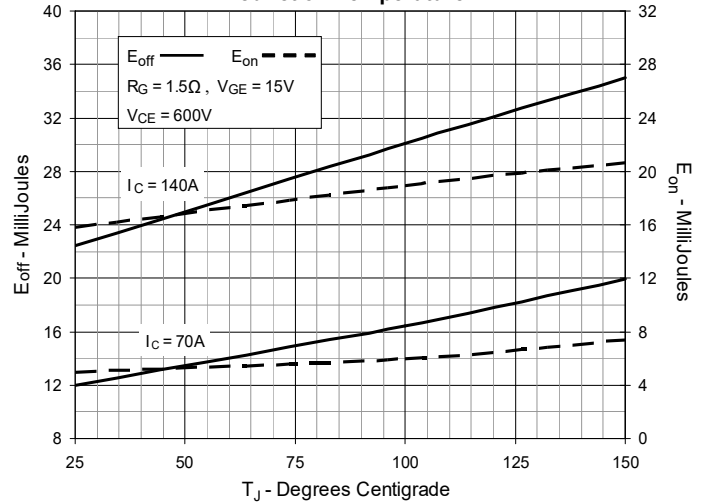
**Fig. 13. Inductive Switching Energy Loss vs. Collector-Emitter Voltage**



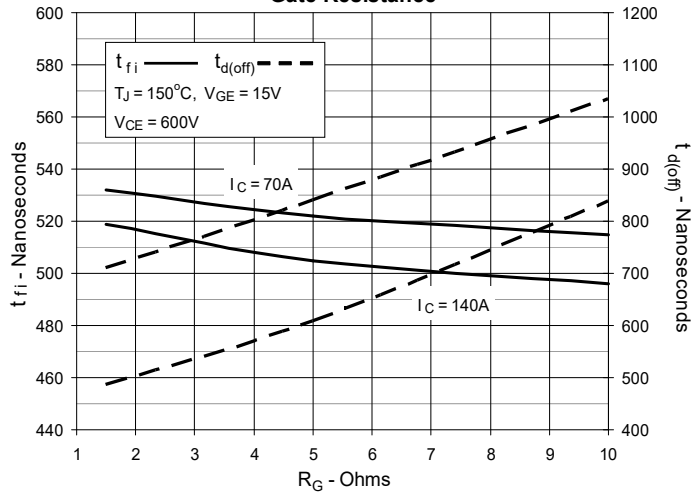
**Fig. 14. Inductive Switching Energy Loss vs. Gate Resistance**



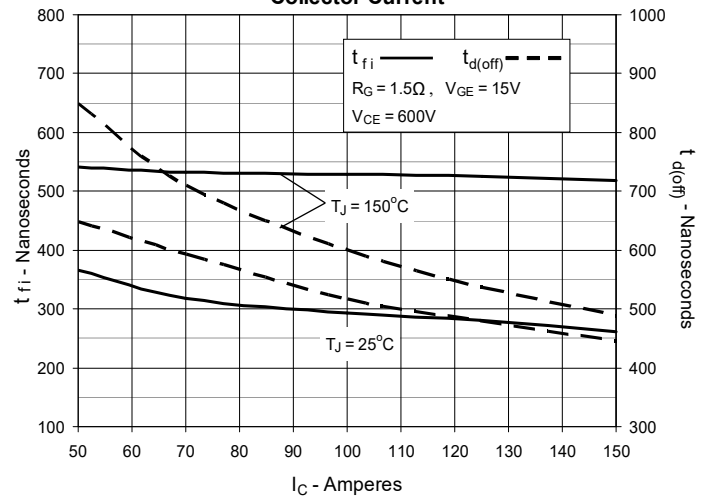
**Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature**



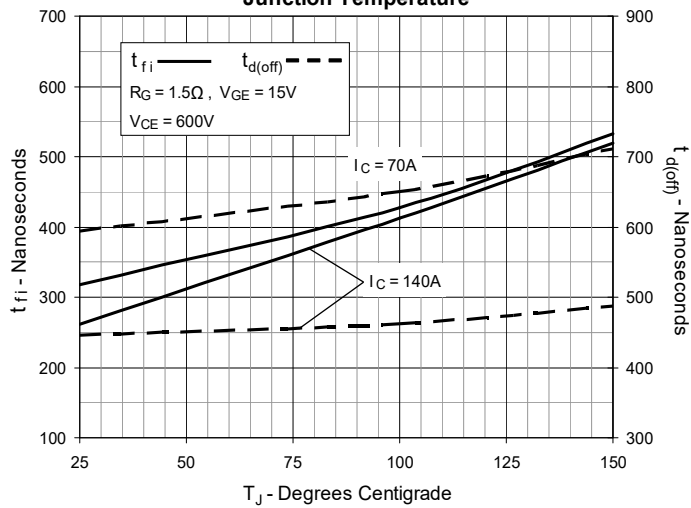
**Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance**



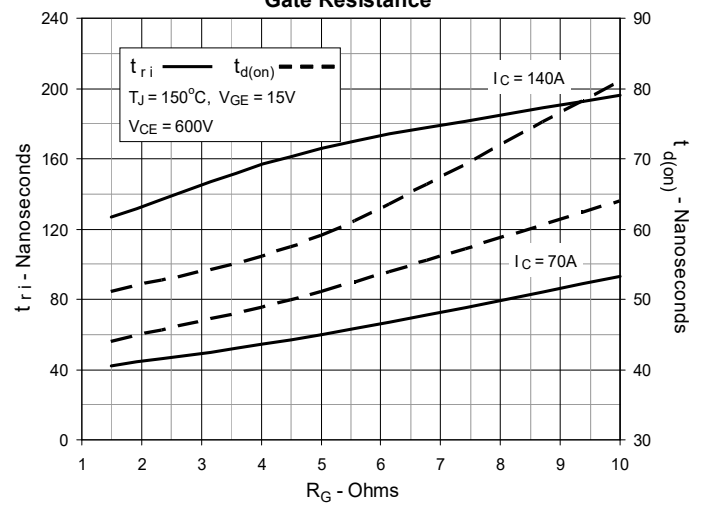
**Fig. 17. Inductive Turn-off Switching Times vs. Collector Current**



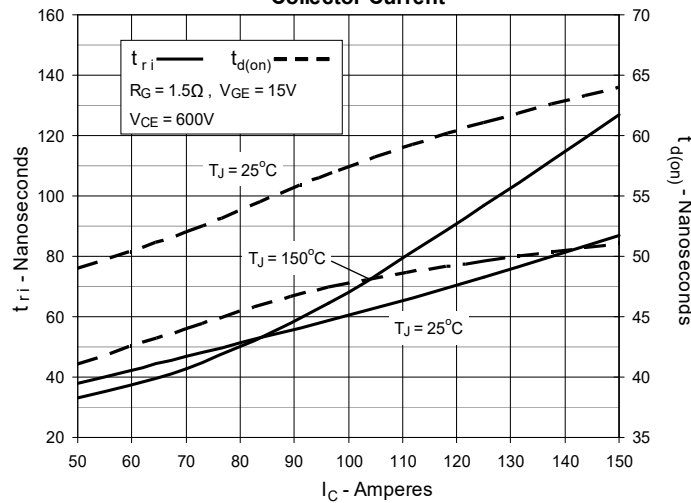
**Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature**



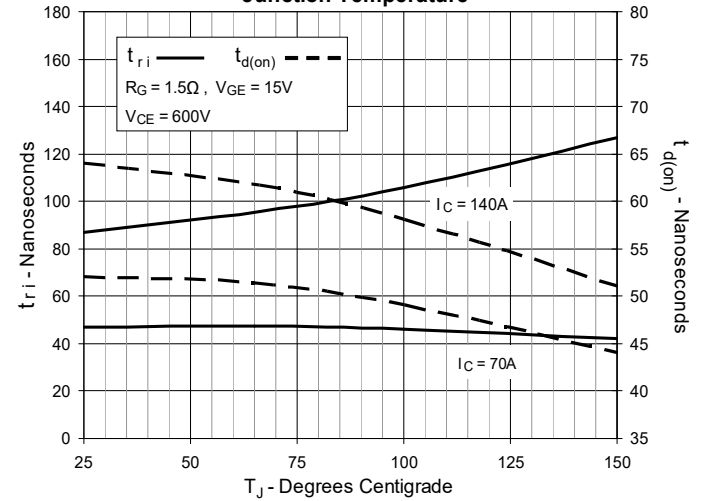
**Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance**



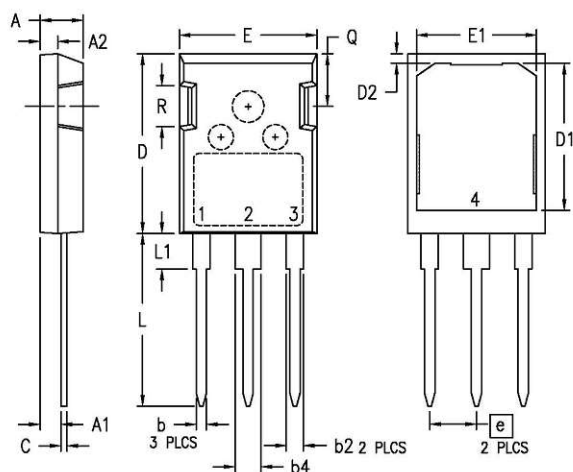
**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**



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



## PLUS247 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  | .520     | .560 | 13.08       | 14.22 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .780     | .810 | 19.81       | 20.57 |
| L1  | .150     | .170 | 3.81        | 4.32  |
| Q   | .220     | .244 | 5.59        | 6.20  |
| R   | .170     | .190 | 4.32        | 4.83  |

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

NOTE: 1. This drawing will meet all dimensions requirement of JEDEC outline TO-247 AD (R-PSIP-F3) except screw mounting hole.  
 2. Pin #2 is connected to the bottom heatsink (#4).  
 3. Lead finish - One of the following depending on the packaging plants.  
 3.1 Matte pure tin plating on the leads and back heatsink.  
 3.2 Pb free solder dip on the leads and pre Ni plated back heatsink.

