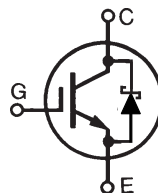


## GenX3™ 600V IGBT w/ SiC Anti-Parallel Diode

## IXGR60N60C3C1

(Electrically Isolated Back Surface)

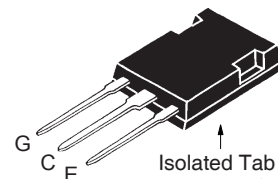
High Speed PT IGBT for 40-100kHz Switching



$$\begin{aligned} V_{CES} &= 600V \\ I_{C110} &= 30A \\ V_{CE(sat)} &\leq 2.5V \\ t_{fi(typ)} &= 50ns \end{aligned}$$

| Symbol                        | Test Conditions   | Maximum Ratings                           |                  |
|-------------------------------|---|---|------------------|
| $V_{CES}$                     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$   | 600                                       | V                |
| $V_{CGR}$                     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GE} = 1M\Omega$                     | 600                                       | V                |
| $V_{GES}$                     | Continuous  | $\pm 20$                                  | V                |
| $V_{GEM}$                     | Transient   | $\pm 30$                                  | V                |
| $I_{C25}$                     | $T_C = 25^\circ\text{C}$ (Limited by leads)   | 75  | A                |
| $I_{C110}$                    | $T_C = 110^\circ\text{C}$   | 30  | A                |
| $I_{F110}$                    | $T_C = 110^\circ\text{C}$   | 13  | A                |
| $I_{CM}$                      | $T_C = 25^\circ\text{C}$ , 1ms  | 260                                       | A                |
| $I_A$                         | $T_C = 25^\circ\text{C}$  | 40  | A                |
| $E_{AS}$                      | $T_C = 25^\circ\text{C}$  | 400                                       | mJ               |
| <b>SSOA</b><br><b>(RBSOA)</b> | $V_{GE} = 15V$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 3\Omega$<br>Clamped Inductive Load | $I_{CM} = 125$<br>@ $V_{CE} \leq V_{CES}$ | A                |
| $P_C$                         | $T_C = 25^\circ\text{C}$  | 170                                       | W                |
| $T_J$                         |   | -55 ... +150                              | $^\circ\text{C}$ |
| $T_{JM}$                      |   | 150                                       | $^\circ\text{C}$ |
| $T_{stg}$                     |   | -55 ... +150                              | $^\circ\text{C}$ |
| $V_{ISOL}$                    | 50/60 Hz, RMS, $t = 1$ minute<br>$I_{ISOL} < 1\text{mA}$ $t = 10$ s                       | 2500<br>3000                              | V~<br>V~         |
| $F_C$                         | Mounting Force  | 20..120/4.5..27                           | N/lb             |
| $T_L$                         | Maximum Lead Temperature for Soldering  | 300                                       | $^\circ\text{C}$ |
| $T_{SOLD}$                    | 1.6mm (0.062 in.) from Case for 10s   | 260                                       | $^\circ\text{C}$ |
| <b>Weight</b>                 |   | 5   | g                |

### ISOPLUS247™



G = Gate      C = Collector  
E = Emitter

### Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Optimized for Low Switching Losses
- Square RBSOA
- Isolated Mounting Surface
- Anti-Parallel Ultra Fast Diode
- High Speed Silicon Carbide Schottky Co-Pack Diode
- No Reverse Recovery
- 2500V Electrical Isolation
- Avalanche Rated

### 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.                     |
| $V_{GE(th)}$  | $I_C = 250\mu\text{A}$ , $V_{CE} = V_{GE}$                                  | 3.0                   |      | 5.5 V                    |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 125^\circ\text{C}$             |                       |      | 50 $\mu\text{A}$<br>1 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$  |                       |      | $\pm 100$ nA             |
| $V_{CE(sat)}$ | $I_C = 40A$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 125^\circ\text{C}$          | 2.2<br>1.7            |      | 2.5 V<br>V               |

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)   | Characteristic Values |  |         |
|--|---|-----------------------|--|---------|
|  |   | Min.                  | Typ.   | Max.    |
| $g_{fs}$   | $I_C = 40\text{A}$ , $V_{CE} = 10\text{V}$ , Note 1   | 23                    | 38   | S       |
| $C_{ies}$<br>$C_{oes}$<br>$C_{res}$  | $V_{CE} = 25\text{V}$ , $V_{GE} = 0\text{V}$ , $f = 1\text{MHz}$  |                       | 2810   | pF      |
|  |   |                       | 210  | pF      |
|  |   |                       | 80   | pF      |
| $Q_g$<br>$Q_{ge}$<br>$Q_{gc}$  | $I_C = 50\text{A}$ , $V_{GE} = 15\text{V}$ , $V_{CE} = 0.5 \cdot V_{CES}$   |                       | 115  | nC      |
|  |   |                       | 43   | nC      |
|  |   |                       | 22   | nC      |
| $t_{d(on)}$<br>$t_{ri}$<br>$E_{on}$<br>$t_{d(off)}$<br>$t_{fi}$<br>$E_{off}$ | <b>Inductive Load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 40\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 480\text{V}$ , $R_G = 3\Omega$<br>Note 2  |                       | 24   | ns      |
|  |   |                       | 40   | ns      |
|  |   |                       | 0.83   | mJ      |
|  |   |                       | 70   | 110 ns  |
|  |   |                       | 50   | ns      |
|  |   |                       | 0.45   | 0.80 mJ |
| $t_{d(on)}$<br>$t_{ri}$<br>$E_{on}$<br>$t_{d(off)}$<br>$t_{fi}$<br>$E_{off}$ | <b>Inductive Load, <math>T_J = 125^\circ\text{C}</math></b><br>$I_C = 40\text{A}$ , $V_{GE} = 15\text{V}$<br>$V_{CE} = 480\text{V}$ , $R_G = 3\Omega$<br>Note 2 |                       | 23   | ns      |
|  |   |                       | 39   | ns      |
|  |   |                       | 0.78   | mJ      |
|  |   |                       | 112  | ns      |
|  |   |                       | 86   | ns      |
|  |   |                       | 0.80   | mJ      |
| $R_{thJC}$<br>$R_{thCS}$   |   |                       | 0.73 $^\circ\text{C/W}$<br>0.15 $^\circ\text{C/W}$ |         |

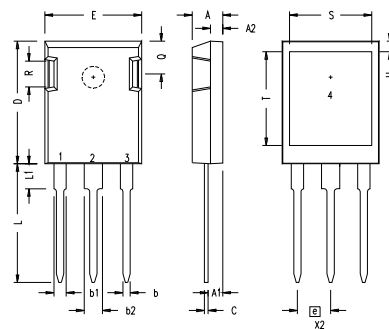
### Reverse Diode (SiC)

| Symbol     | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)     | Characteristic Values |              |                         |
|------------|---|-----------------------|--------------|-------------------------|
|            |   | Min.                  | Typ.         | Max.                    |
| $V_F$      | $I_F = 20\text{A}$ , $V_{GE} = 0\text{V}$ , Note 1<br>$T_J = 125^\circ\text{C}$ |                       | 1.65<br>1.80 | V<br>V                  |
| $R_{thJC}$ |   |                       |              | 1.75 $^\circ\text{C/W}$ |

### 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  $R_G$ .

### ISOPLUS247 (IXGR) Outline



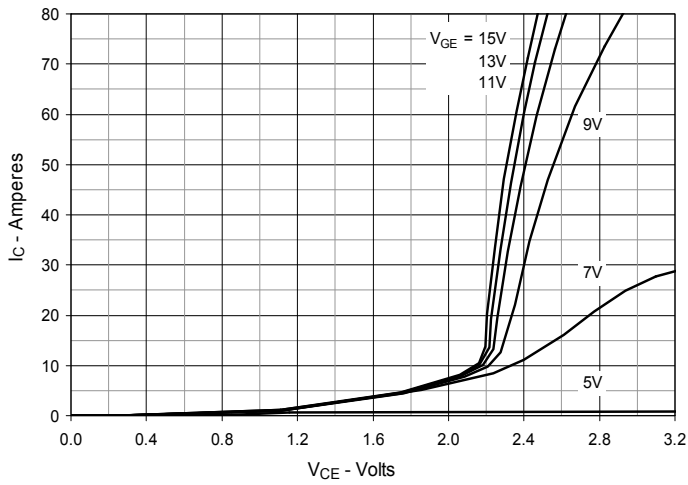
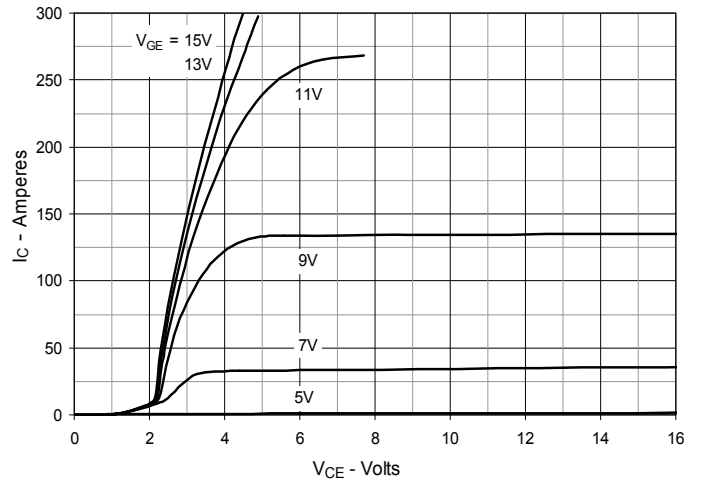
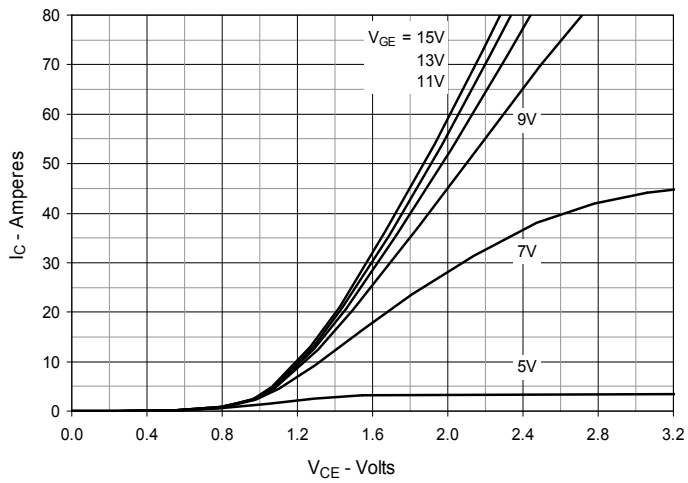
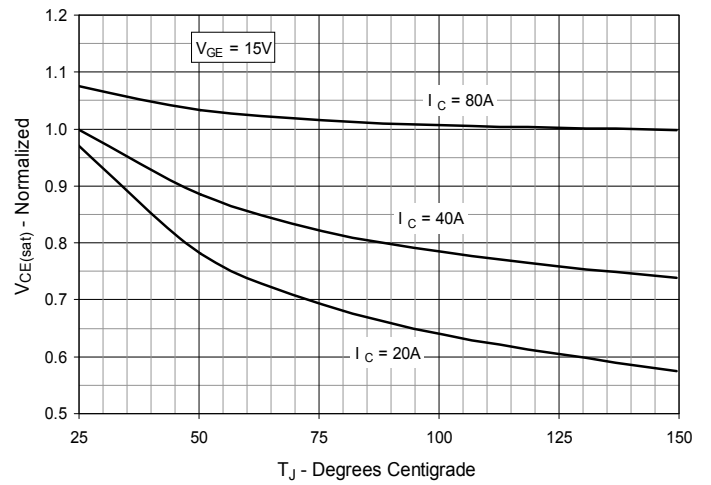
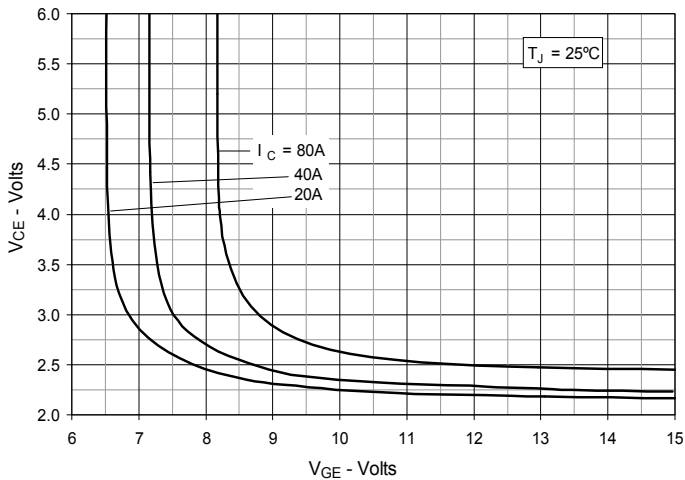
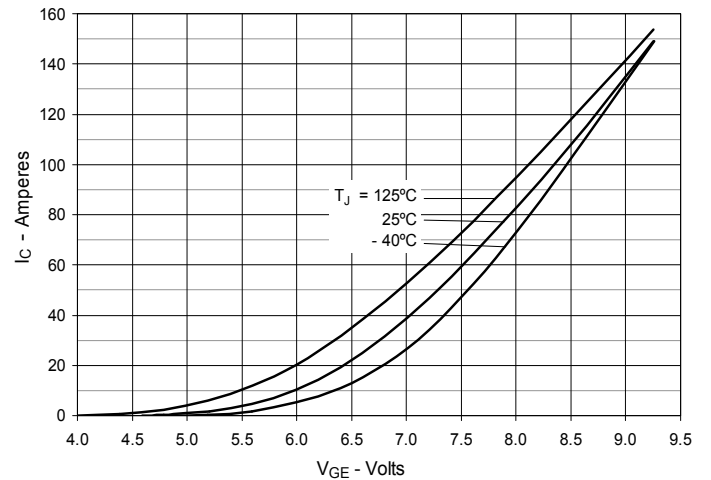
| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .190     | .205 | 4.83        | 5.21  |
| A1  | .090     | .100 | 2.29        | 2.54  |
| A2  | .075     | .085 | 1.91        | 2.16  |
| b   | .045     | .055 | 1.14        | 1.40  |
| b1  | .075     | .084 | 1.91        | 2.13  |
| b2  | .115     | .123 | 2.92        | 3.12  |
| C   | .024     | .031 | 0.61        | 0.80  |
| D   | .819     | .840 | 20.80       | 21.34 |
| E   | .620     | .635 | 15.75       | 16.13 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .780     | .800 | 19.81       | 20.32 |
| L1  | .150     | .170 | 3.81        | 4.32  |
| Q   | .220     | .244 | 5.59        | 6.20  |
| R   | .170     | .190 | 4.32        | 4.83  |
| S   | .520     | .540 | 13.21       | 13.72 |
| T   | .620     | .640 | 15.75       | 16.26 |
| U   | .065     | .080 | 1.65        | 2.03  |

- 1 - GATE
- 2 - DRAIN (COLLECTOR)
- 3 - SOURCE (EMITTER)
- 4 - NO CONNECTION

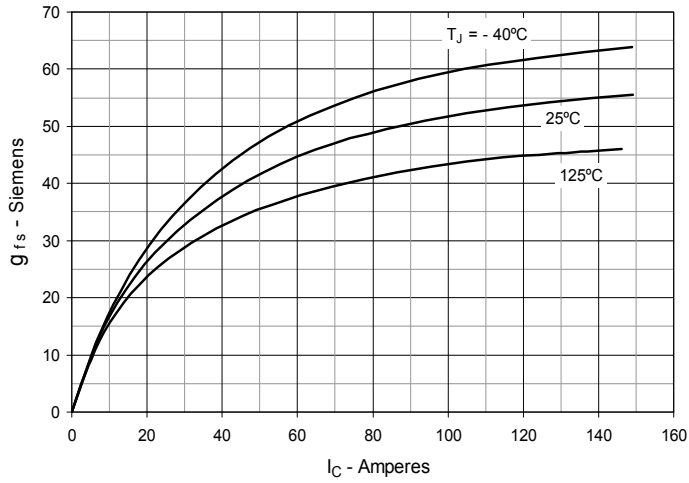
NOTE: This drawing will meet all dimensions requirement of JEDEC outline TO-247AD except screw hole.

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

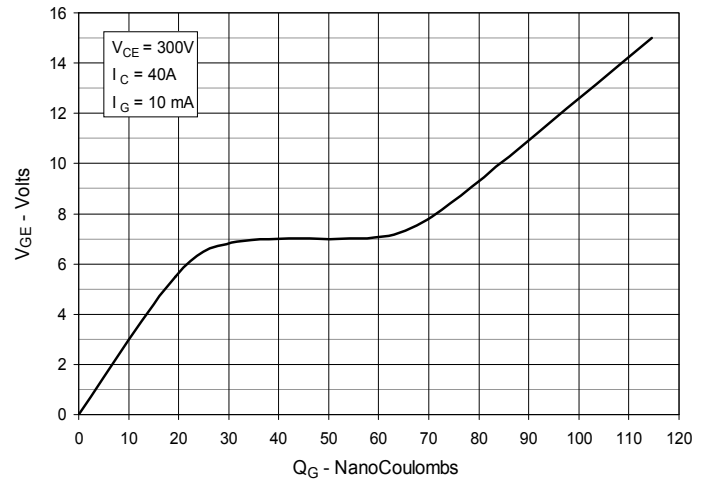
|  |           |           |           |           |              |              |              |              |              |             |
|--|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| IXYS MOSFETs and 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 |
|  | 4,850,072 | 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 @  $T_J = 125^\circ\text{C}$** 

**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**


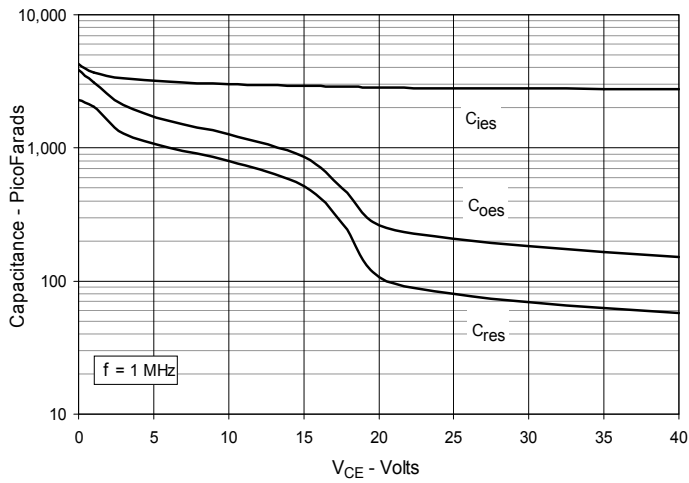
**Fig. 7. Transconductance**



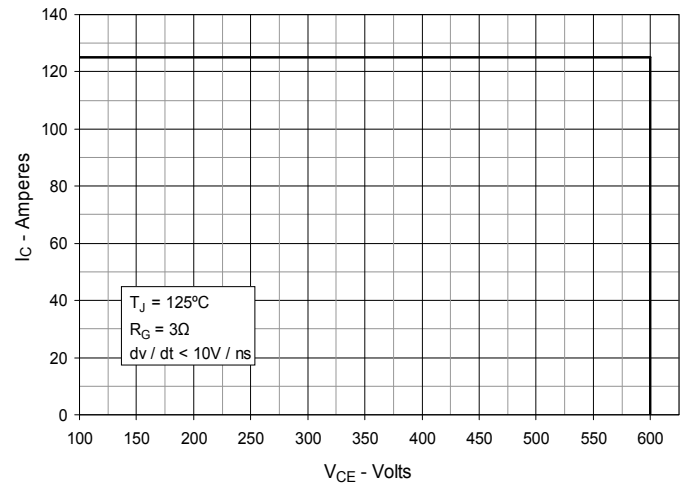
**Fig. 8. Gate Charge**



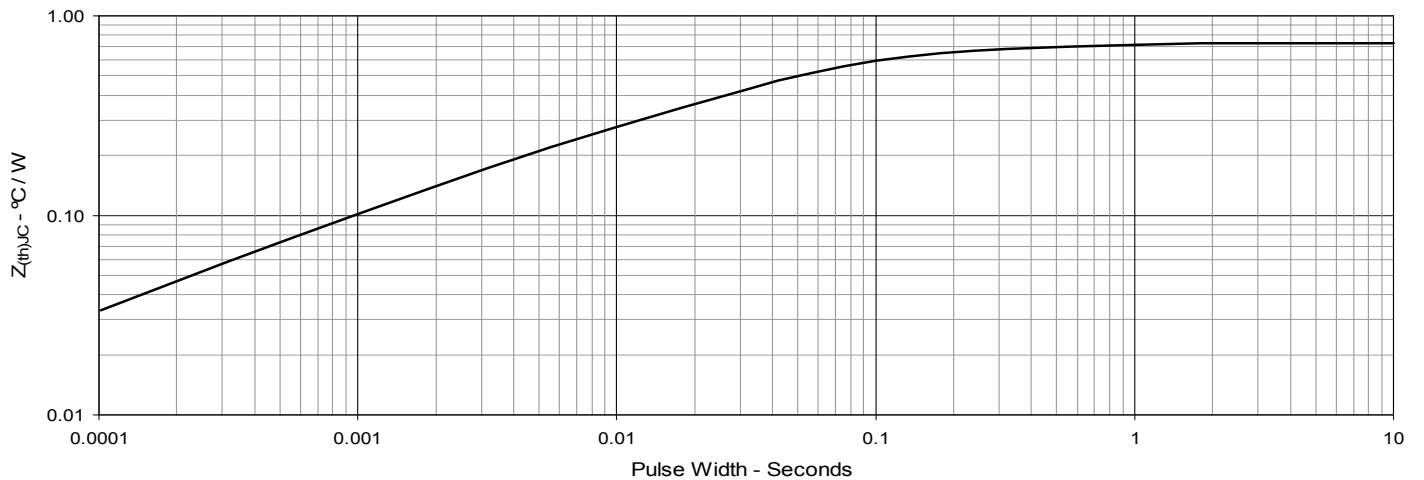
**Fig. 9. Capacitance**

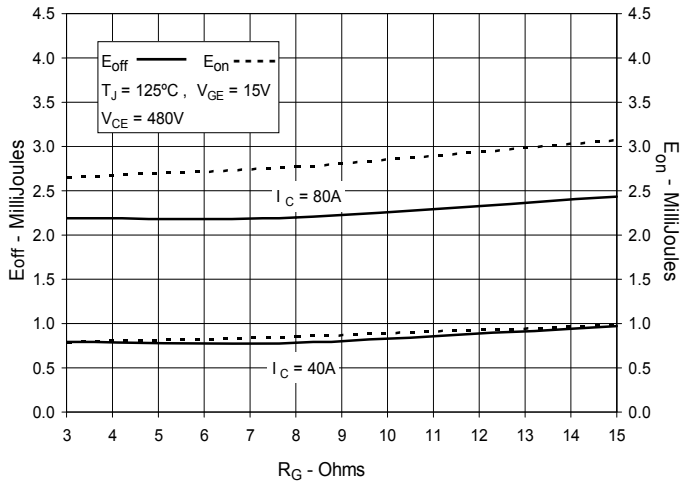
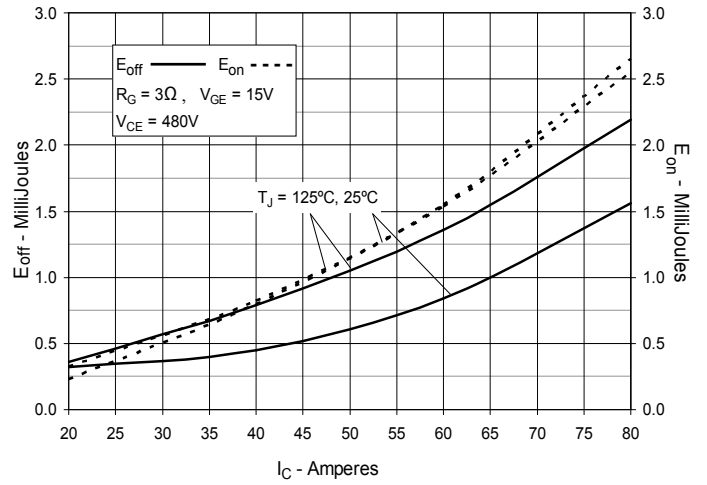
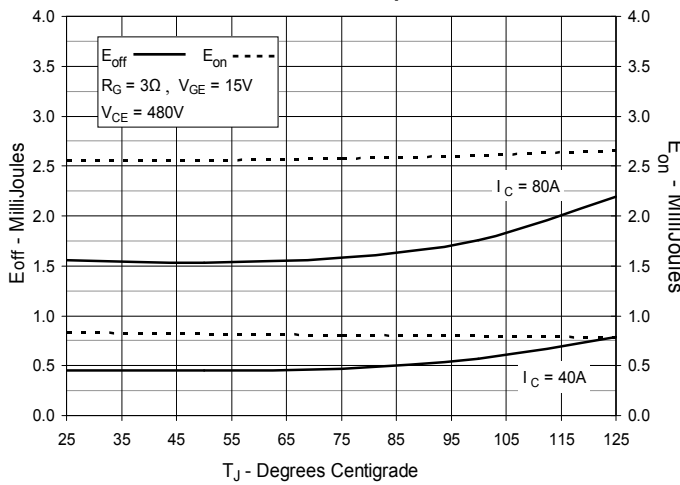
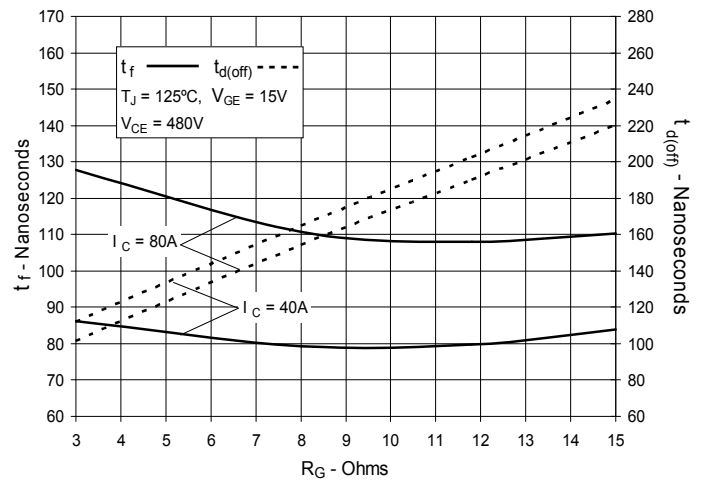
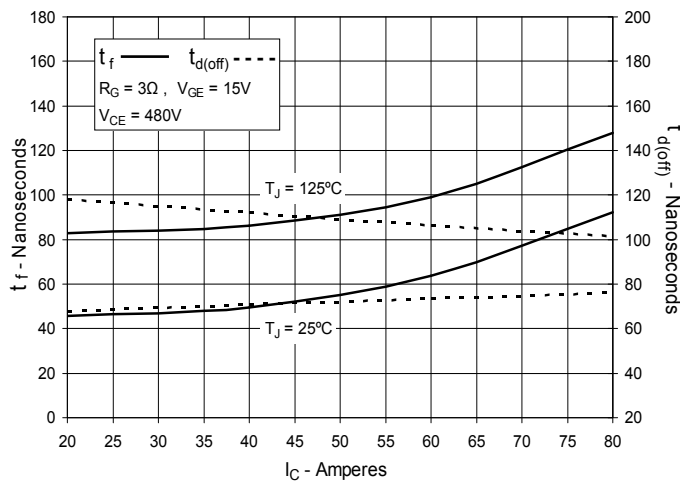
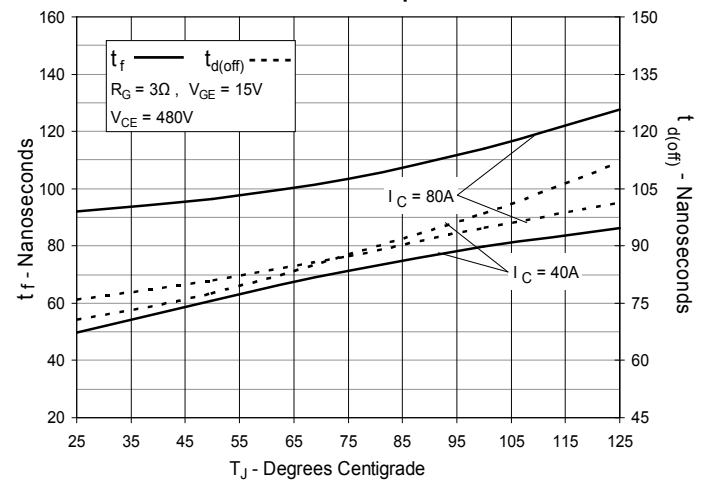


**Fig. 10. Reverse-Bias Safe Operating Area**

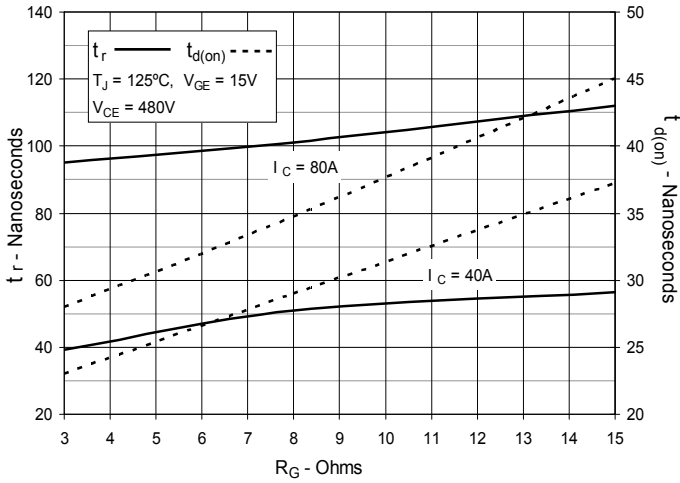


**Fig. 11. Maximum Transient Thermal Impedance**

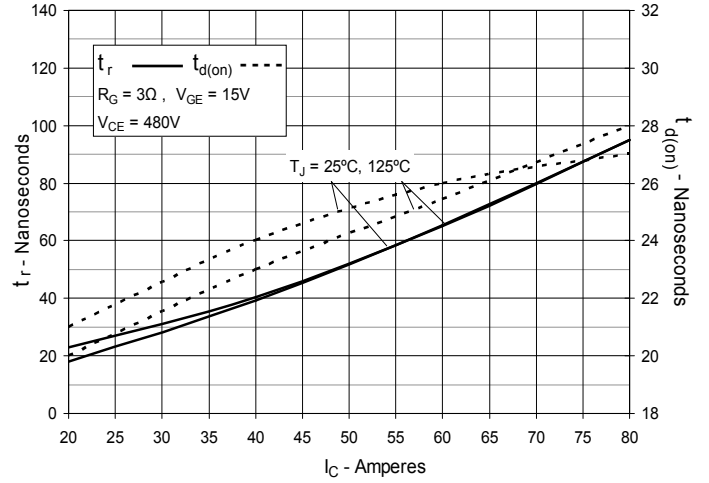


**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**

**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**


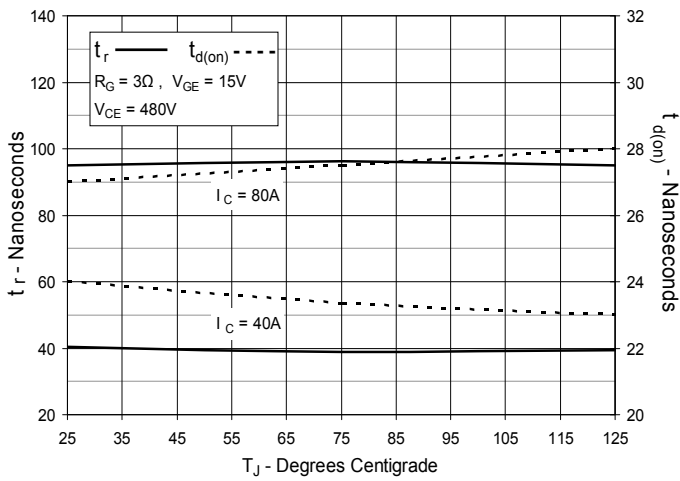
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



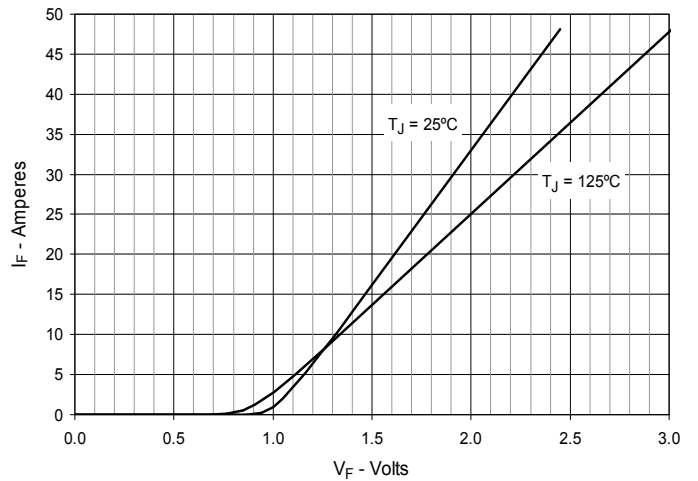
**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**



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



**Fig. 21. Forward Current vs. Forward Voltage**



**Fig. 22. Maximum Transient Thermal Impedance for Diodes**

