

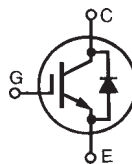
### IGBT with Diode

IXGR 50N60A2U1

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 75 \text{ A} \\ V_{CE(sat)} &= 1.7 \text{ V} \end{aligned}$$

Low Saturation Voltage IGBT with  
Low Forward Drop Diode  
Electrically Isolated Mounting Tab

#### Preliminary Data Sheet

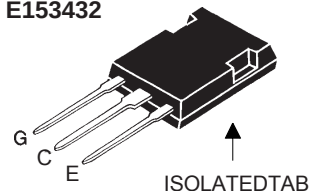


| Symbol                                                                          | Test Conditions                                                                                                              | Maximum Ratings |                  |
|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| $V_{CES}$                                                                       | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$                                                                               | 600             | V                |
| $V_{CGR}$                                                                       | $T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$                                                   | 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                |
| $I_{C110}$                                                                      | $T_C = 110^\circ\text{C}$                                                                                                    | 50              | A                |
| $I_{F110}$                                                                      | $T_C = 110^\circ\text{C}$ (50N60A2U1 Diode)                                                                                  | 25              | A                |
| $I_{CM}$                                                                        | $T_C = 25^\circ\text{C}, 1 \text{ ms}$                                                                                       | 200             | A                |
| <b>SSOA</b><br><b>(RBSOA)</b>                                                   | $V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$<br>Clamped inductive load @ $V_{CE} \leq 600 \text{ V}$ | $I_{CM} = 80$   | A                |
| $P_C$                                                                           | $T_C = 25^\circ\text{C}$                                                                                                     | 200             | W                |
| $T_J$                                                                           |                                                                                                                              | -55 ... +150    | $^\circ\text{C}$ |
| $T_{JM}$                                                                        |                                                                                                                              | 150             | $^\circ\text{C}$ |
| $T_{stg}$                                                                       |                                                                                                                              | -55 ... +150    | $^\circ\text{C}$ |
| Maximum lead temperature for soldering<br>1.6 mm (0.062 in.) from case for 10 s |                                                                                                                              | 300             | $^\circ\text{C}$ |
| $F_C$                                                                           | Mounting Force                                                                                                               | 22..130/5..29   | N/lb             |
| $V_{ISOL}$                                                                      | 50/60 Hz, RMS, $t = 1 \text{ minute}$<br>$I_{SOL} = 1 \text{ mA}, t = 1 \text{ s}$                                           | 2500<br>3000    | V~<br>V~         |
| <b>Weight</b>                                                                   |                                                                                                                              | 4               | g                |
| Maximum lead temperature for soldering<br>1.6 mm (0.062 in.) from case for 10 s |                                                                                                                              | 300             | $^\circ\text{C}$ |

ISOPLUS247(IXGR)



E153432



G = Gate      C = Collector  
E = Emitter

#### Features

- Low on-state voltage IGBT and anti-parallel diode in one package
- High current handling capability
- MOS Gate turn-on for drive simplicity

#### Applications

- Lighting controls
- Heating controls
- AC/DC relays

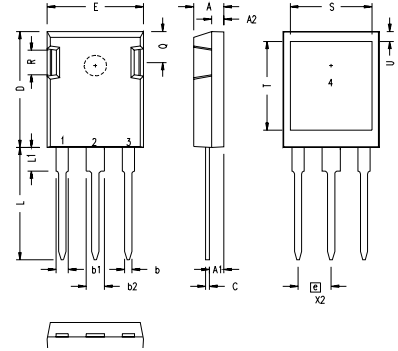
#### Advantages

- Space savings (two devices in one package)
- Easy to mount with 1 screw or spring clip

| Symbol        | Test Conditions                                       | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                           |
|---------------|-------------------------------------------------------|-----------------------------------------------------------------------------------|------|---------------------------|
|               |                                                       | Min.                                                                              | Typ. | Max.                      |
| $V_{GE(th)}$  | $I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$              | 3.0                                                                               |      | 5.0                       |
| $I_{CES}$     | $V_{CE} = V_{CES}$<br>$V_{GE} = 0 \text{ V}$          |                                                                                   |      | 650 $\mu\text{A}$<br>5 mA |
| $I_{GES}$     | $V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$     |                                                                                   |      | $\pm 100 \text{ nA}$      |
| $V_{CE(sat)}$ | $I_C = 50 \text{ A}, V_{GE} = 15 \text{ V}$<br>Note 1 |                                                                                   | 1.3  | 1.7                       |

| Symbol       | Test Conditions                                                                                                                                      | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |          |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|----------|
|              |                                                                                                                                                      | Min.                                                                              | Typ. | Max.     |
| $g_{fs}$     | $I_C = 50\text{ A}$ ; $V_{CE} = 10\text{ V}$ ,<br>Note 1                                                                                             | 40                                                                                | 55   | S        |
| $C_{ies}$    | $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 1\text{ MHz}$                                                                                  |                                                                                   | 3500 | pF       |
| $C_{oes}$    |                                                                                                                                                      |                                                                                   | 400  | pF       |
| $C_{res}$    |                                                                                                                                                      |                                                                                   | 50   | pF       |
| $Q_g$        | $I_C = 50\text{ A}$ , $V_{GE} = 15\text{ V}$ , $V_{CE} = 0.5\text{ V}_{CES}$                                                                         |                                                                                   | 140  | nC       |
| $Q_{ge}$     |                                                                                                                                                      |                                                                                   | 23   | nC       |
| $Q_{gc}$     |                                                                                                                                                      |                                                                                   | 44   | nC       |
| $t_{d(on)}$  | Inductive load, $T_J = 25^\circ\text{C}$<br>$I_C = 50\text{ A}$ , $V_{GE} = 15\text{ V}$<br>$V_{CE} = 480\text{ V}$ , $R_G = R_{off} = 5.0\ \Omega$  |                                                                                   | 20   | ns       |
| $t_{ri}$     |                                                                                                                                                      |                                                                                   | 25   | ns       |
| $t_{d(off)}$ |                                                                                                                                                      |                                                                                   | 410  | ns       |
| $t_{fi}$     |                                                                                                                                                      |                                                                                   | 260  | ns       |
| $E_{off}$    |                                                                                                                                                      |                                                                                   | 3.5  | mJ       |
| $t_{d(on)}$  | Inductive load, $T_J = 125^\circ\text{C}$<br>$I_C = 50\text{ A}$ , $V_{GE} = 15\text{ V}$<br>$V_{CE} = 480\text{ V}$ , $R_G = R_{off} = 5.0\ \Omega$ |                                                                                   | 20   | ns       |
| $t_{ri}$     |                                                                                                                                                      |                                                                                   | 25   | ns       |
| $E_{on}$     |                                                                                                                                                      |                                                                                   | 1.0  | mJ       |
| $t_{d(off)}$ |                                                                                                                                                      |                                                                                   | 720  | ns       |
| $t_{fi}$     |                                                                                                                                                      |                                                                                   | 510  | ns       |
| $E_{off}$    |                                                                                                                                                      |                                                                                   | 7.7  | mJ       |
| $R_{thJC}$   |                                                                                                                                                      |                                                                                   | 0.15 | 0.62 K/W |
| $R_{thCK}$   |                                                                                                                                                      |                                                                                   |      | K/W      |

### ISOPLUS247 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.

| Reverse Diode (FRED) |                                                         | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |          |
|----------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------|------|----------|
| Symbol               | Test Conditions                                         | min.                                                                              | typ. | max.     |
| $V_F$                | $I_F = 50\text{ A}$ , $V_{GE} = 0\text{ V}$ ,<br>Note 1 |                                                                                   |      | 1.6 V    |
| $R_{thJC}$           |                                                         |                                                                                   |      | 0.95 K/W |

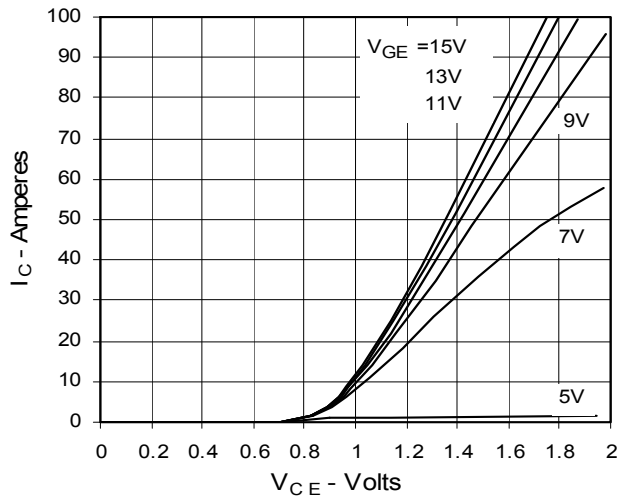
Note 1: Pulse test,  $t \leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$

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

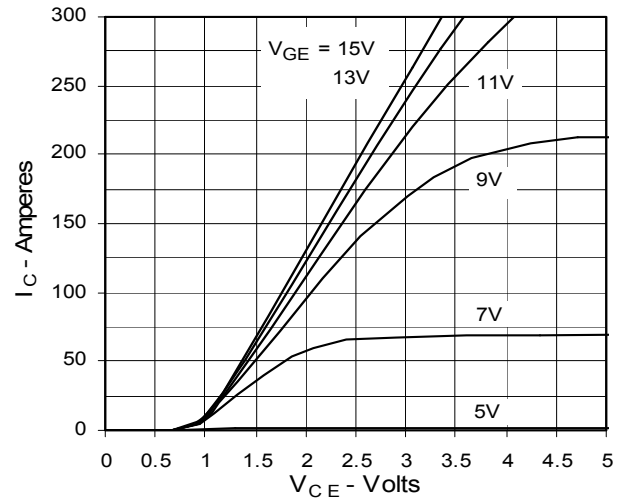
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |              |              |              |              |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|
| 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    |
| 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    |
| 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 |

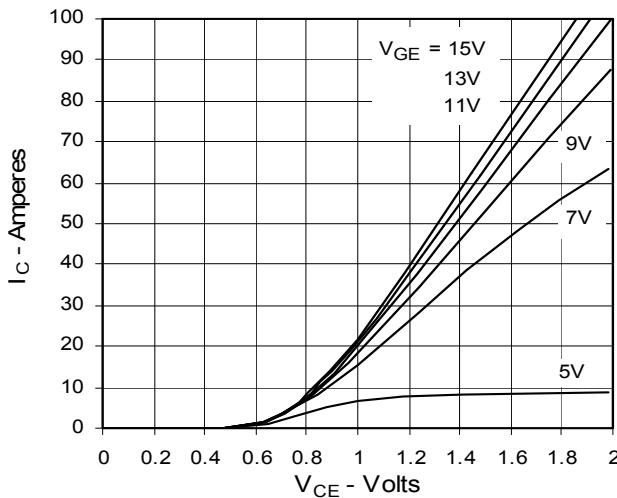
**Fig. 1. Output Characteristics**  
@ 25 °C



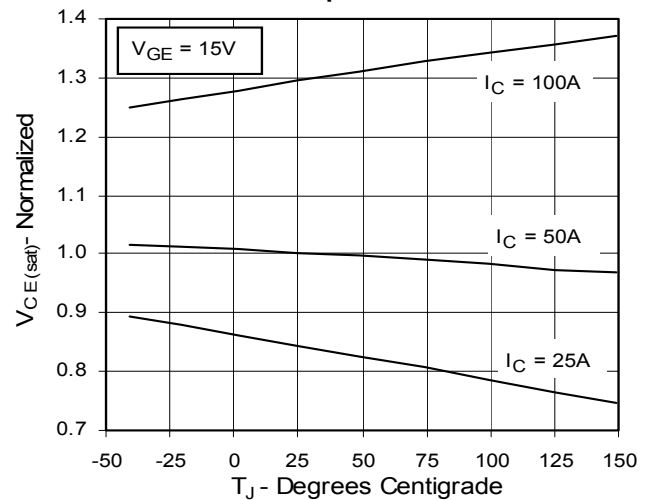
**Fig. 2. Extended Output Characteristics**  
@ 25 °C



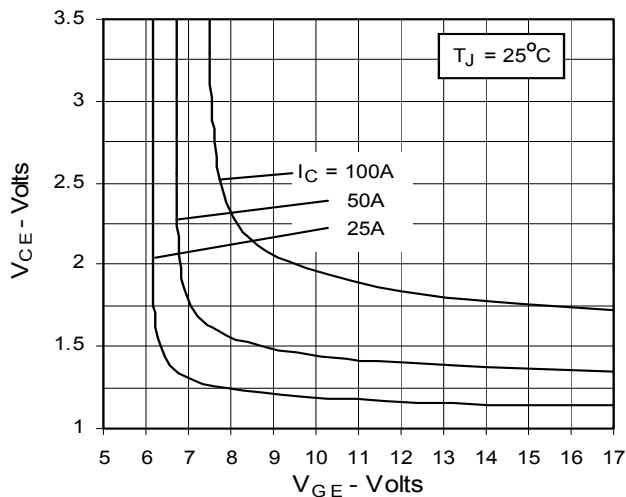
**Fig. 3. Output Characteristics**  
@ 125 °C



**Fig. 4. Dependence of  $V_{CE(sat)}$  on Temperature**



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage**



**Fig. 6. Input Admittance**

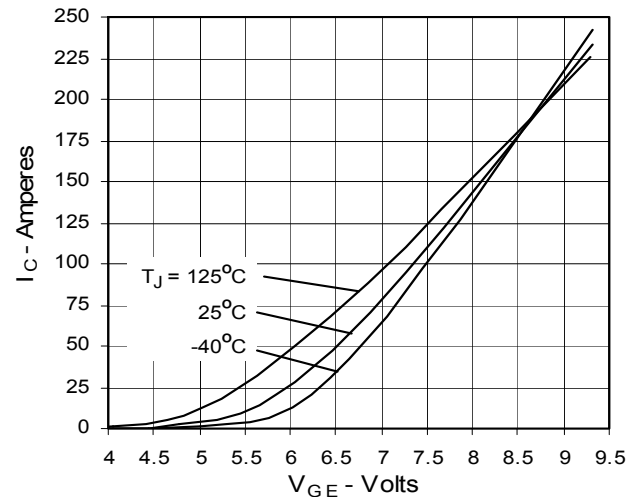


Fig. 7. Transconductance

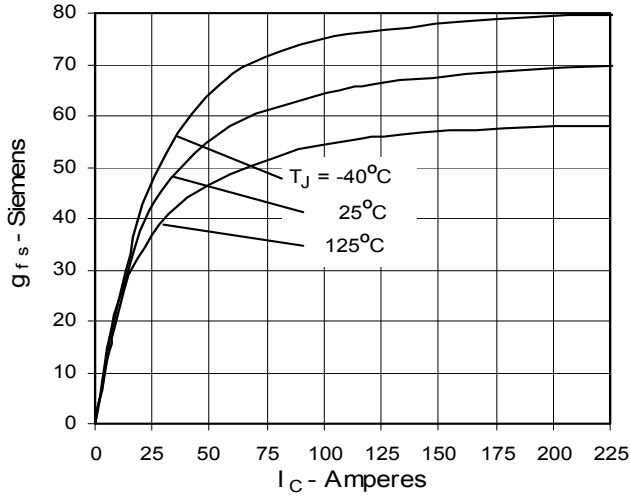
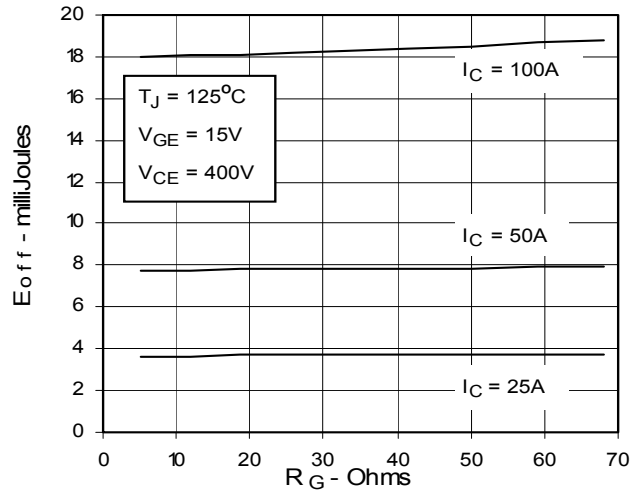
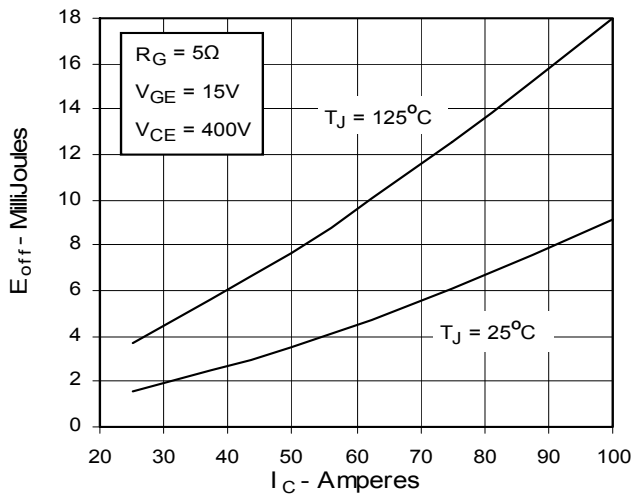
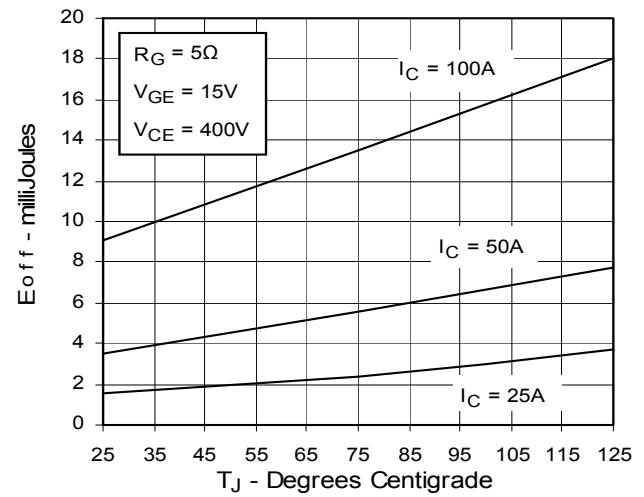
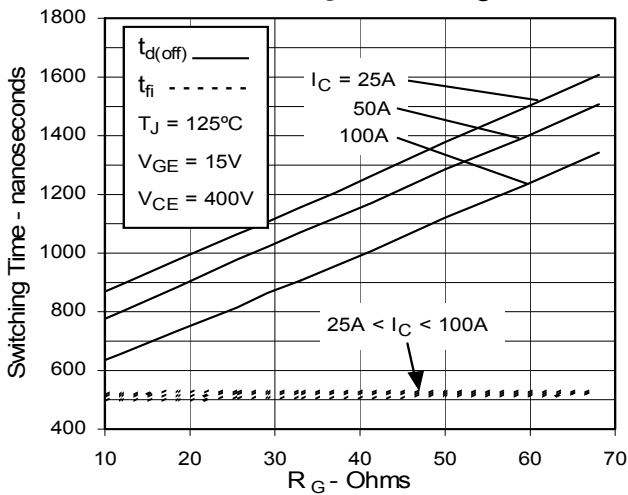
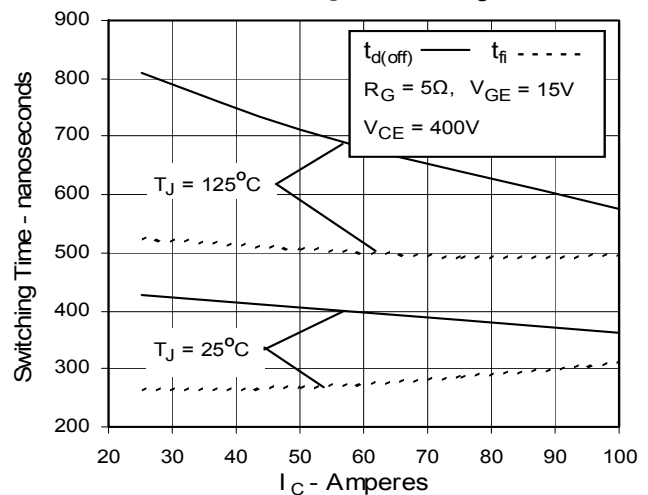
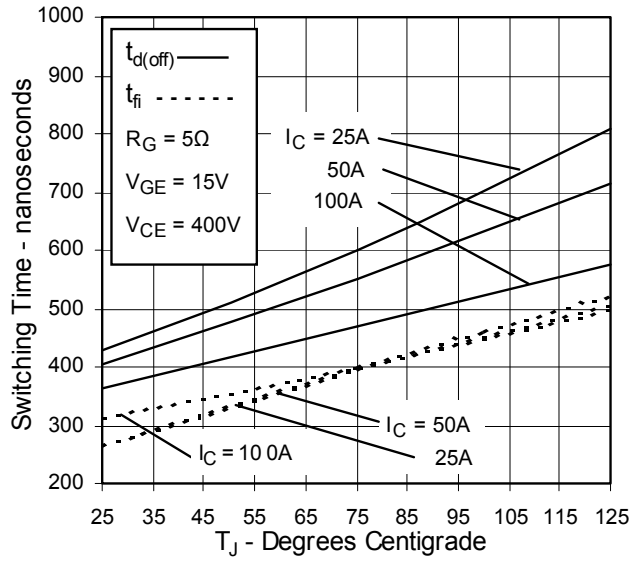

Fig. 8. Dependence of Turn-off Energy Loss on  $R_G$ 

Fig. 9. Dependence of Turn-Off Energy Loss on  $I_C$ 


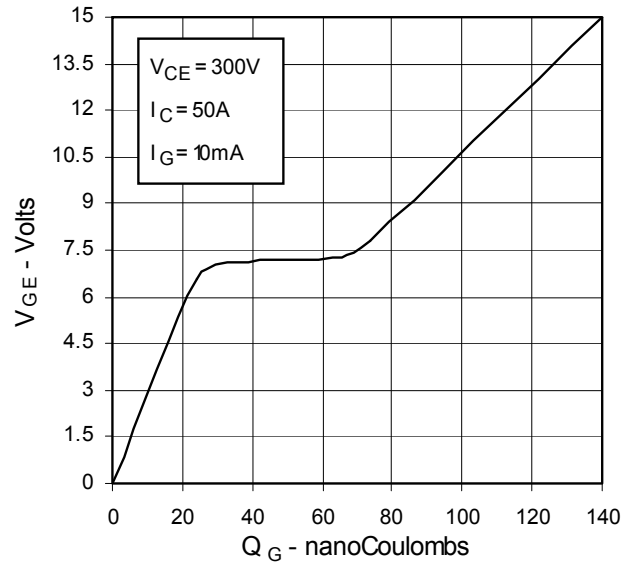
Fig. 10. Dependence of Turn-off Energy Loss on Temperature


Fig. 11. Dependence of Turn-off Switching Time on  $R_G$ 

Fig. 12. Dependence of Turn-off Switching Time on  $I_C$ 


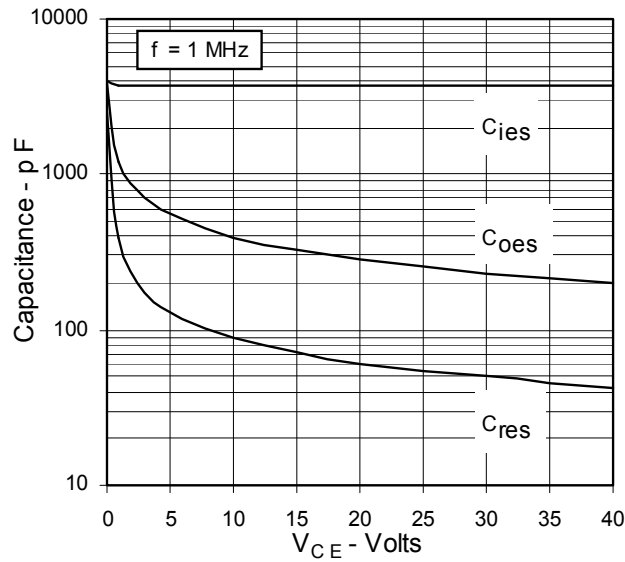
**Fig. 13. Dependence of Turn-off Switching Time on Temperature**



**Fig. 14. Gate Charge**



**Fig. 15. Capacitance**



**Fig. 16. Reverse-Bias Safe Operating Area**

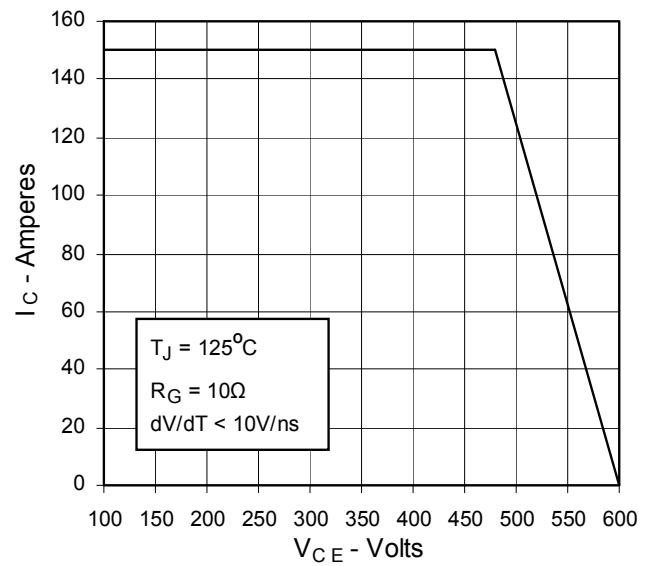


Fig. 17. Maximum Transient Thermal Resistance

