

# HiPerFAST™ IGBT ISOPLUS247™

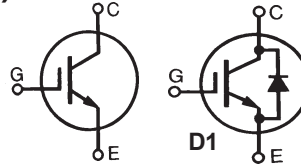
IXGR 40N60B2  
IXGR 40N60B2D1

$V_{CES} = 600\text{ V}$   
 $I_{C25} = 75\text{ A}$   
 $V_{CE(sat)} = 1.9\text{ V}$   
 $t_{fi\text{typ}} = 82\text{ ns}$

## C2-Class High Speed IGBTs (Electrically Isolated Back Surface)

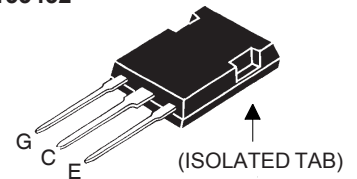
Optimized for 10-25 KHz hard switching  
and up to 150 KHz resonant switching

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                |
| $I_{C25}$                     | $T_C = 25^\circ\text{C}$   | 60              | A                |
| $I_{C110}$                    | $T_C = 110^\circ\text{C}$  | 33              | A                |
| $I_{F110}$                    | $T_C = 110^\circ\text{C}$ (IXGR40N60B2D1)  | 25              | A                |
| $I_{CM}$                      | $T_C = 25^\circ\text{C}$ , 1 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 @ $\leq 600\text{ V}$ | $I_{CM} = 80$   | A                |
| $P_C$                         | $T_C = 25^\circ\text{C}$   | 167             | 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, $t = 1\text{ m}$   | 2500            | V                |
|                               | Maximum lead temperature for soldering<br>1.6 mm (0.062 in.) from case for 10 s  | 300             | $^\circ\text{C}$ |
| <b>Weight</b>                 |  | 6               | g                |

ISOPLUS247 (IXGR)  
E153432



G = Gate,  
E = Emitter

C = Collector,

### Features

- DCB Isolated mounting tab
- Meets TO-247AD package Outline
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

### Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

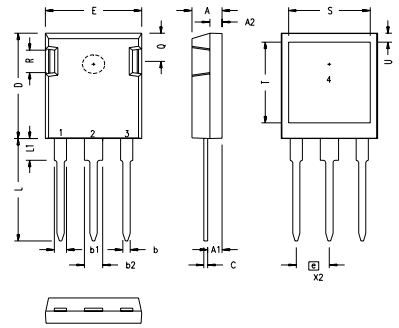
### Advantages

- Easy assembly
- High power density
- Very fast switching speeds for high frequency applications

| 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 V                    |
| $I_{CES}$     | $V_{CE} = V_{CES}$<br>$V_{GE} = 0\text{ V}$        |   |      | 50 $\mu\text{A}$<br>1 mA |
| $I_{GES}$     | $V_{CE} = 0\text{ V}$ , $V_{GE} = \pm 20\text{ V}$ |   |      | $\pm 100\text{ nA}$      |
| $V_{CE(sat)}$ | $I_C = 30\text{ A}$ , $V_{GE} = 15\text{ V}$       |   |      | 1.9 V                    |

| Symbol   | Test Conditions  | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |      |    |
|--|--|---|------|------|----|
|  |  | min.  | typ. | max. |    |
| $g_{fs}$   | $I_C = 30\text{ A}$ ; $V_{CE} = 10\text{ V}$ ,<br>Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $\leq 2\%$                            | 20  | 36   | S    |    |
| $C_{ies}$<br>$C_{oes}$<br>$C_{res}$  | $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 1\text{ MHz}$  |   | 2560 | pF   |    |
|  |  |   | 210  | pF   |    |
|  |  |   | 54   | pF   |    |
| $Q_g$<br>$Q_{ge}$<br>$Q_{gc}$  | $I_C = 30\text{ A}$ , $V_{GE} = 15\text{ V}$ , $V_{CE} = 300\text{ V}$   |   | 100  | nC   |    |
|  |  |   | 15   | nC   |    |
|  |  |   | 36   | nC   |    |
| $t_{d(on)}$<br>$t_{ri}$<br>$t_{d(off)}$<br>$t_{fi}$<br>$E_{off}$             | Inductive load, $T_J = 25^\circ\text{C}$<br>$I_C = 30\text{ A}$ , $V_{GE} = 15\text{ V}$<br>$V_{CE} = 400\text{ V}$ , $R_G = 3.3\ \Omega$  |   | 18   | ns   |    |
|  |  |   | 20   | ns   |    |
|  |  |   | 130  | 200  | ns |
|  |  |   | 82   | 150  | ns |
|  |  |   | 0.4  | 0.8  | mJ |
| $t_{d(on)}$<br>$t_{ri}$<br>$E_{on}$<br>$t_{d(off)}$<br>$t_{fi}$<br>$E_{off}$ | Inductive load, $T_J = 125^\circ\text{C}$<br>$I_C = 30\text{ A}$ , $V_{GE} = 15\text{ V}$<br>$V_{CE} = 400\text{ V}$ , $R_G = 3.3\ \Omega$ |   | 18   | ns   |    |
|  |  |   | 20   | ns   |    |
|  |  |   | 0.3  | mJ   |    |
|  |  |   | 240  | ns   |    |
|  |  |   | 150  | ns   |    |
|  |  |   | 1.10 | mJ   |    |
| $R_{thJC}$<br>$R_{thCK}$   |  |   | 0.75 | KW   |    |
|  |  | 0.15  |      | KW   |    |

### ISOPLUS 247 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

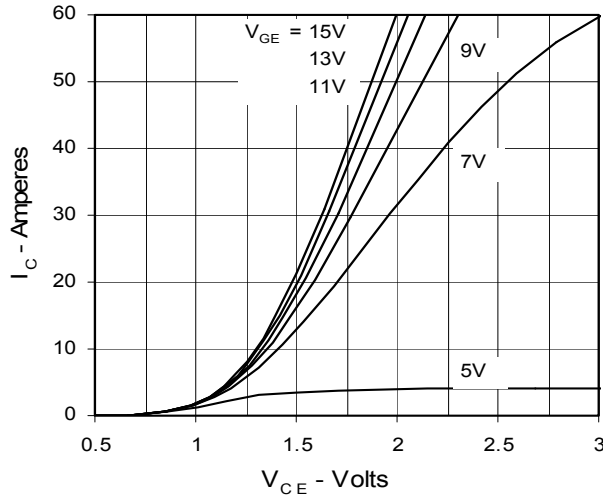
NOTE: This drawing will meet all dimensions requirement of JEDEC outline TO-247AD except screw hole.

| Symbol               | Test Conditions   | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                |
|----------------------|---|---|------|----------------|
|                      |   | min.  | typ. | max.           |
| $V_F$                | $I_F = 30\text{ A}$ , $V_{GE} = 0\text{ V}$ , Pulse test<br>$t \leq 300\ \mu\text{s}$ , duty cycle $d \leq 2\%$   |   |      | 1.6 V<br>2.5 V |
| $I_{RM}$<br>$t_{rr}$ | $I_F = 30\text{ A}$ , $V_{GE} = 0\text{ V}$ , $-di_F/dt = 100\text{ A}/\mu\text{s}$ , $T_J = 100^\circ\text{C}$<br>$V_R = 100\text{ V}$ , $T_J = 100^\circ\text{C}$<br>$I_F = 1\text{ A}$ ; $-di/dt = 100\text{ A}/\mu\text{s}$ ; $V_R = 30\text{ V}$ |   | 100  | 4 A<br>ns      |
|                      |   |   | 25   | ns             |
| $R_{thJC}$           |   | 0.9   | 1.1  | KW             |

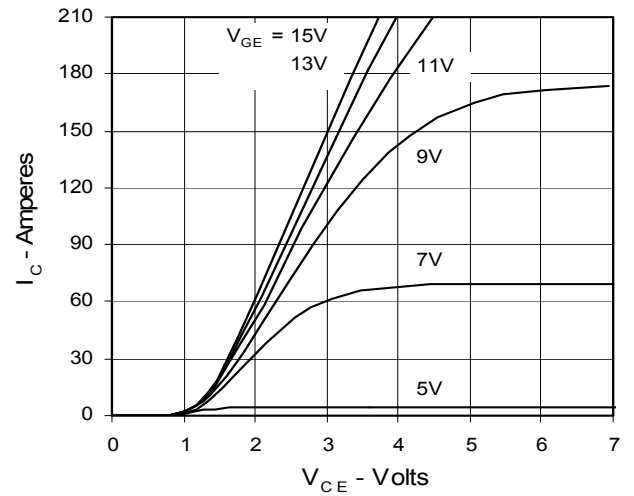
IXYS reserves the right to change limits, test conditions, and dimensions.

|  |           |           |           |           |              |             |             |           |
|--|-----------|-----------|-----------|-----------|--------------|-------------|-------------|-----------|
| 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    | 6,404,065B1 | 6,683,344   | 6,727,585 |
|  | 4,850,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123B1  | 6,534,343   | 6,710,405B2 |           |
|  | 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728 B1 | 6,583,505   | 6,710,463   |           |

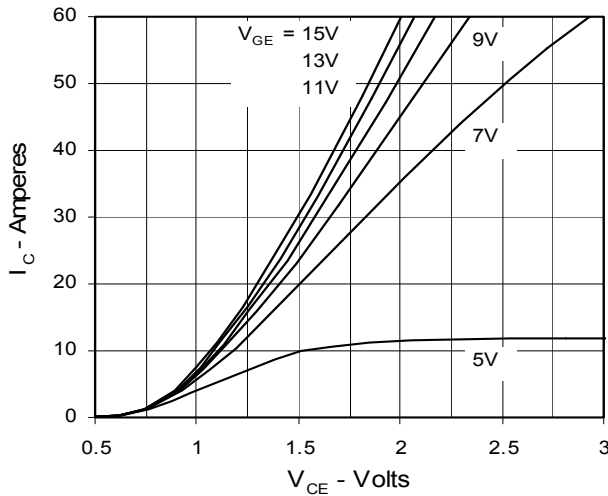
**Fig. 1. Output Characteristics @ 25 Deg. C**



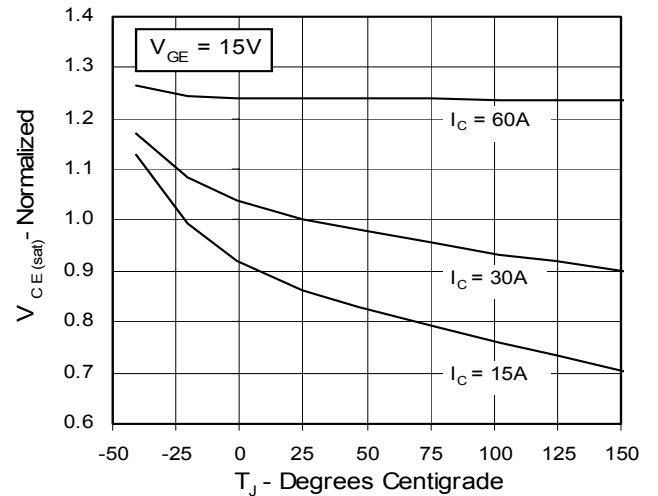
**Fig. 2. Extended Output Characteristics @ 25 deg. C**



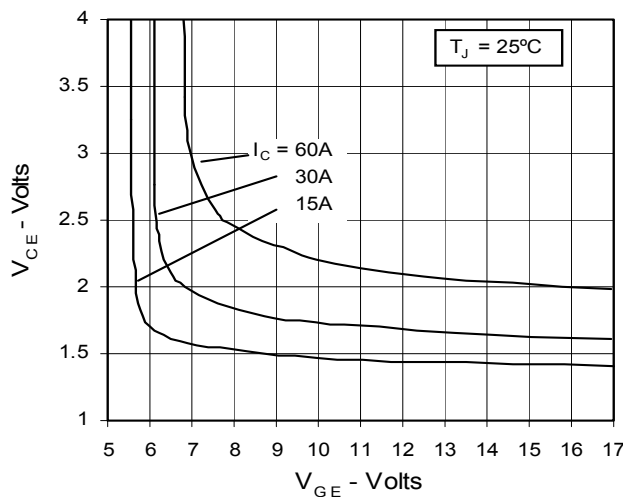
**Fig. 3. Output Characteristics @ 125 Deg. C**



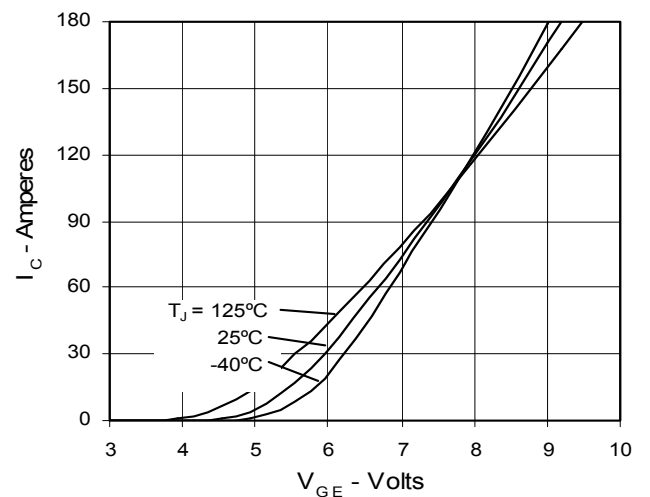
**Fig. 4. Dependence of  $V_{CE(sat)}$  on Temperature**



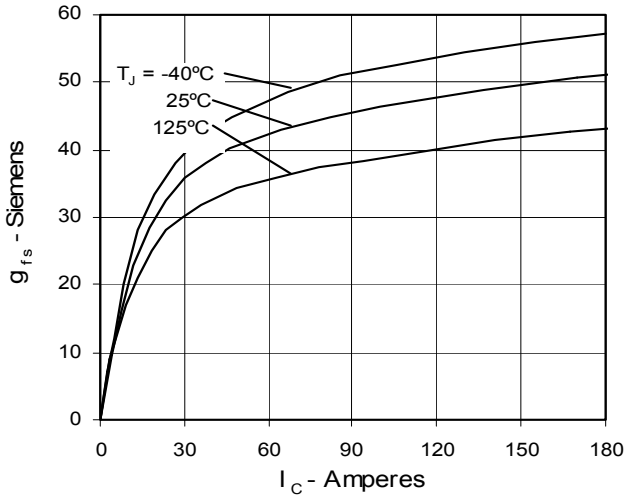
**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage**



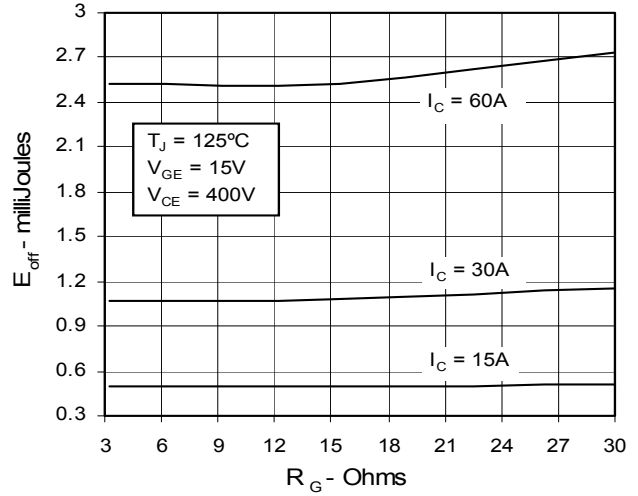
**Fig. 6. Input Admittance**



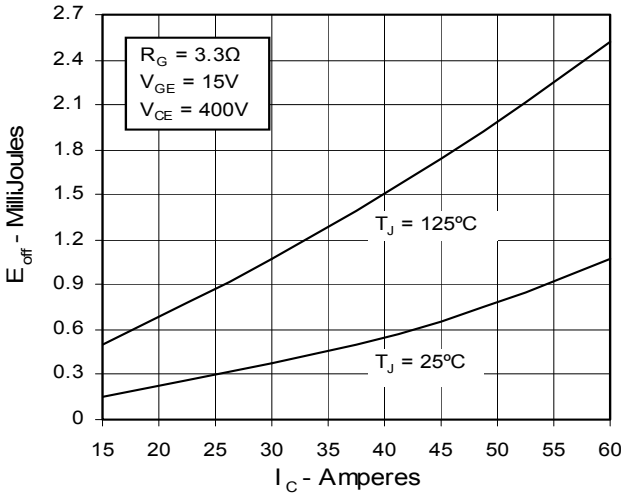
**Fig. 7. Transconductance**



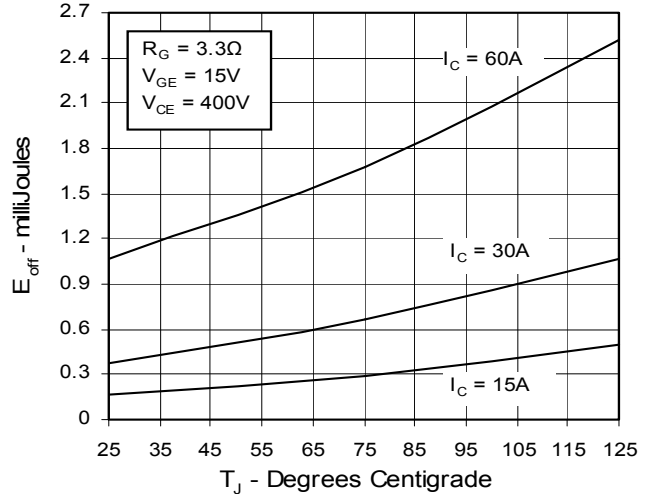
**Fig. 8. Dependence of Turn-Off Energy on  $R_G$**



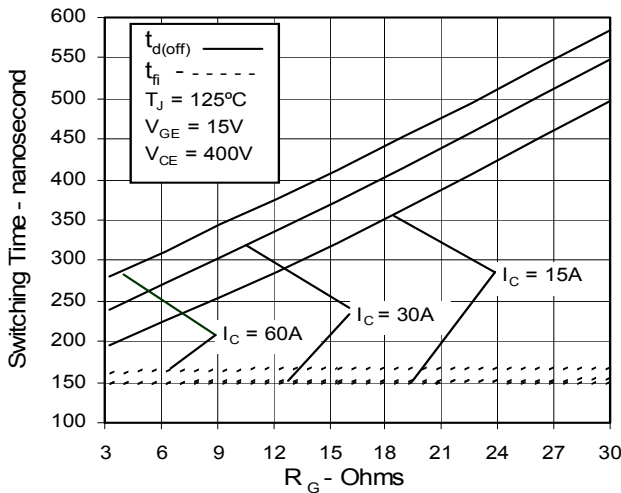
**Fig. 9. Dependence of Turn-Off Energy on  $I_C$**



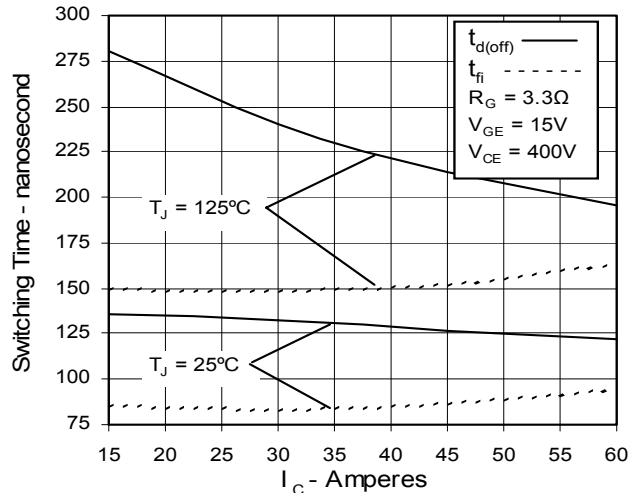
**Fig. 10. Dependence of Turn-Off Energy on Temperature**



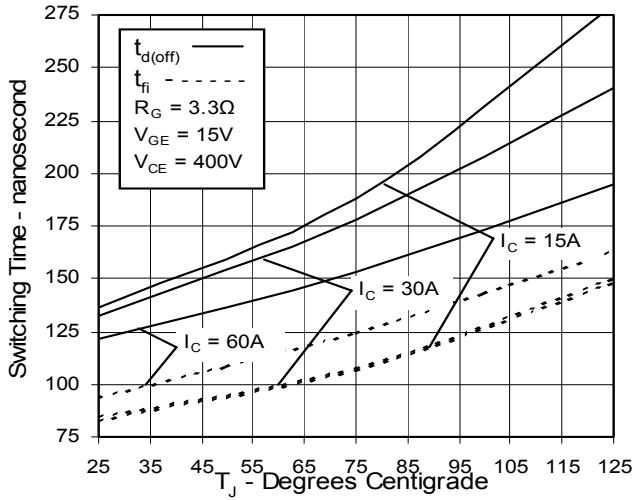
**Fig. 11. Dependence of Turn-Off Switching Time on  $R_G$**



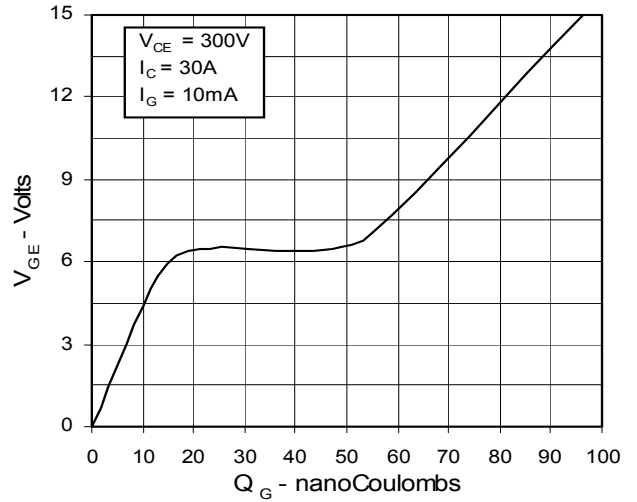
**Fig. 12. Dependence of Turn-Off Switching Time on  $I_C$**



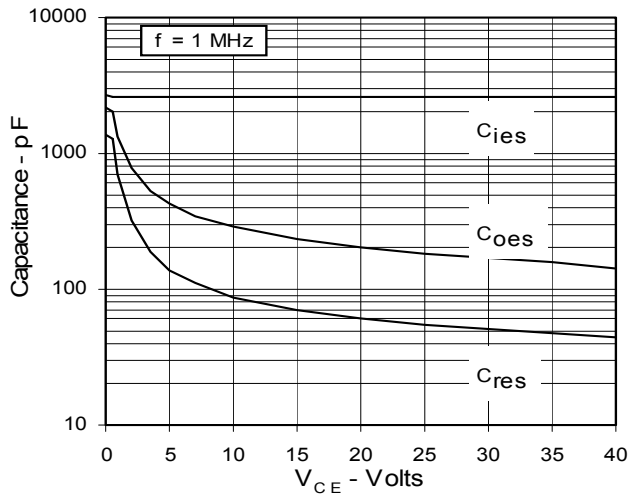
**Fig. 13. Dependence of Turn-Off Switching Time on Temperature**



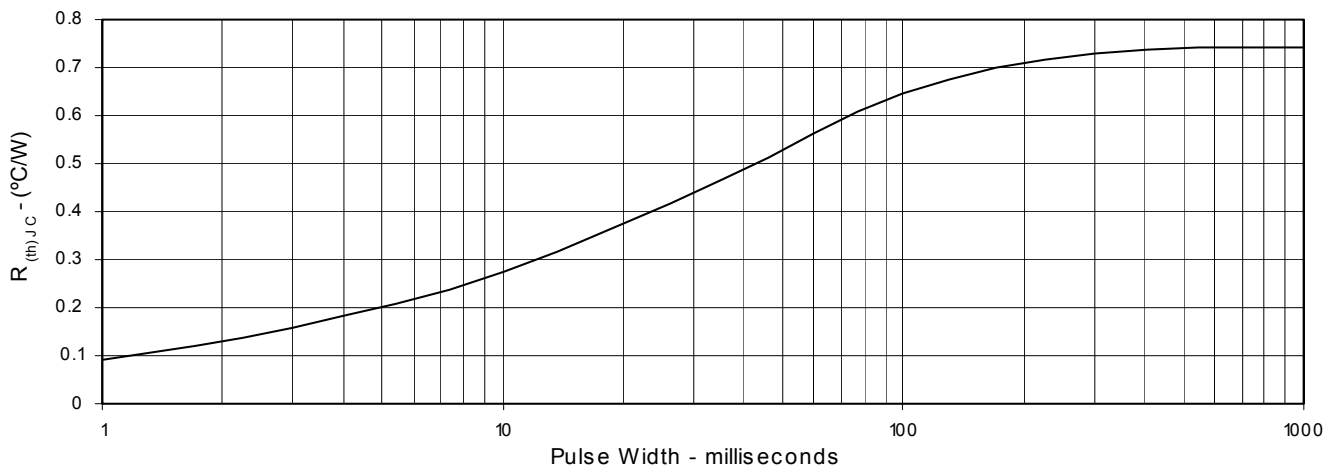
**Fig. 14. Gate Charge**



**Fig. 15. Capacitance**



**Fig. 13. Maximum Transient Thermal Resistance**



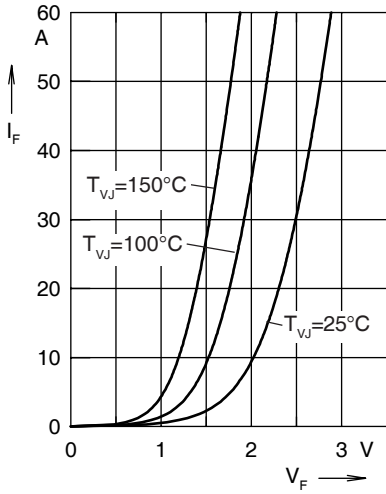


Fig. 17 Forward current  $I_F$  versus  $V_F$

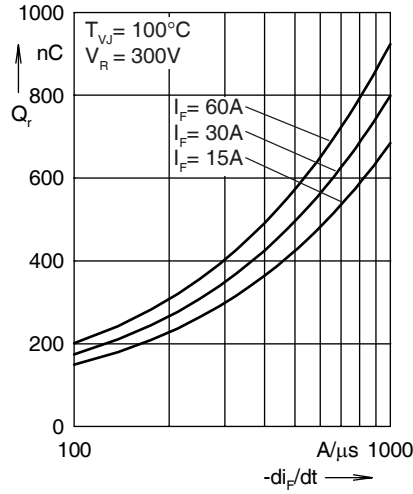


Fig. 18 Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

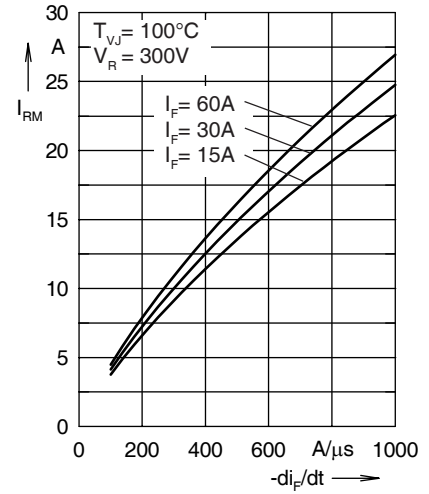


Fig. 19 Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

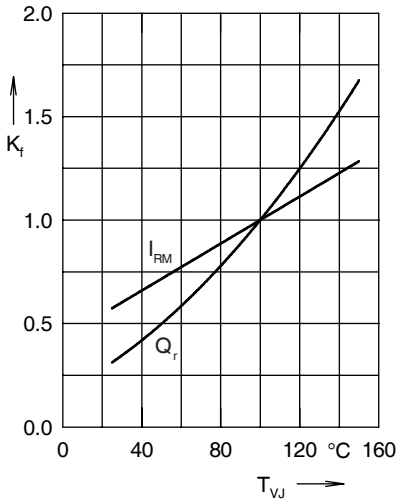


Fig. 20 Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

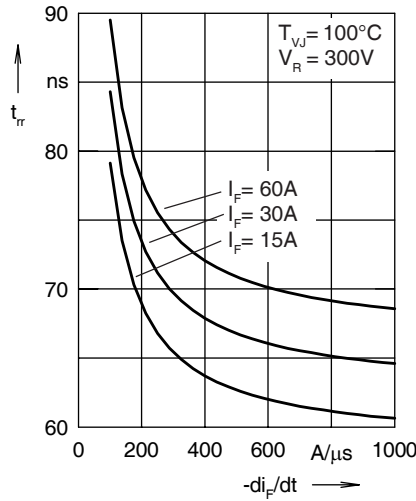


Fig. 21 Recovery time  $t_{tr}$  versus  $-di_F/dt$

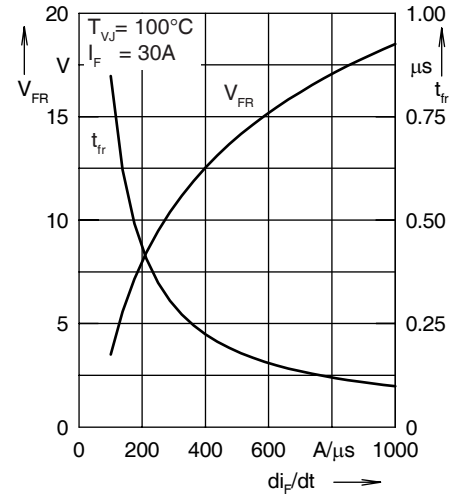


Fig. 22 Peak forward voltage  $V_{FR}$  and  $t_{tr}$  versus  $di_F/dt$

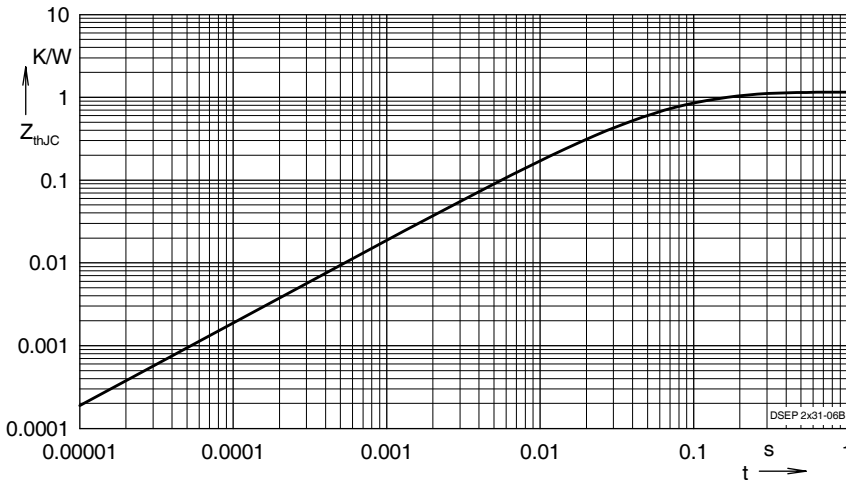


Fig. 23 Transient thermal resistance junction to case

Constants for  $Z_{thJC}$  calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|-----------------|-----------|
| 1 | 0.436           | 0.0055    |
| 2 | 0.482           | 0.0092    |
| 3 | 0.117           | 0.0007    |
| 4 | 0.115           | 0.0418    |