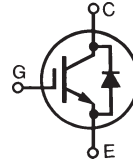


# HiPerFAST™ IGBT IXGR 32N90B2D1 with Fast Diode

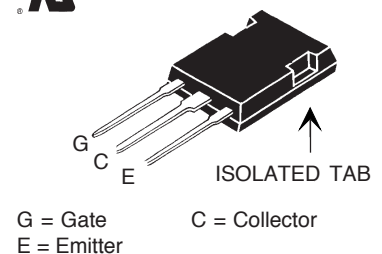
## Electrically Isolated Base



$$\begin{aligned} V_{CES} &= 900 \text{ V} \\ I_{C25} &= 47 \text{ A} \\ V_{CE(sat)} &= 2.9 \text{ V} \\ t_{fi\text{typ}} &= 150 \text{ ns} \end{aligned}$$

| Symbol                                                                          | Test Conditions                                                                                                                | Maximum Ratings |                  |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| $V_{CES}$                                                                       | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                                                                                | 900             | V                |
| $V_{CGR}$                                                                       | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ ; $R_{GE} = 1 \text{ M}\Omega$                                                 | 900             | V                |
| $V_{GES}$                                                                       | Continuous                                                                                                                     | $\pm 20$        | V                |
| $V_{GEM}$                                                                       | Transient                                                                                                                      | $\pm 30$        | V                |
| $I_{C25}$                                                                       | $T_C = 25^\circ\text{C}$                                                                                                       | 47              | A                |
| $I_{C110}$                                                                      | $T_C = 110^\circ\text{C}$                                                                                                      | 22              | A                |
| $I_{CM}$                                                                        | $T_C = 25^\circ\text{C}$ , 1 ms                                                                                                | 200             | A                |
| <b>SSOA (RBSOA)</b>                                                             | $V_{GE} = 15 \text{ V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 10 \Omega$<br>Clamped inductive load: $V_{CL} < 600 \text{ V}$ | $I_{CM} = 64$   | A                |
| $P_C$                                                                           | $T_C = 25^\circ\text{C}$                                                                                                       | 160             | 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             | $^\circ\text{C}$ |
| $V_{ISOL}$                                                                      | 50/60Hz, RMS, $T = 1$ minute<br>$I_{isol} < 1 \text{ mA}$                                                                      | 2500<br>3000    | V~<br>V~         |
| $F_C$                                                                           | Mounting force                                                                                                                 | 20..120/4.5..26 | N/lb             |
| Weight                                                                          |                                                                                                                                | 5               | g                |

ISOPLUS247 (IXGR)  
E153432



### Features

- Electrically isolated mounting tab
- High frequency IGBT
- High current handling capability
- MOS Gate turn-on - drive simplicity

### Applications

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

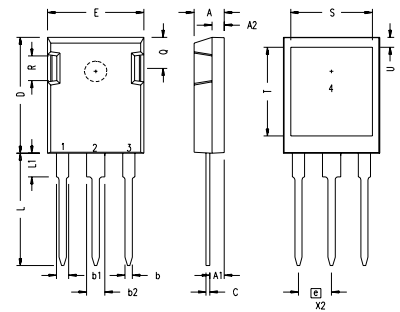
### Advantages

- 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>$V_{GE} = 0 \text{ V}$<br>$T_J = 150^\circ\text{C}$   |                                                                                 |      | 300 $\mu\text{A}$<br>1.5 mA |
| $I_{GES}$     | $V_{CE} = 0 \text{ V}$ , $V_{GE} = \pm 20 \text{ V}$                        |                                                                                 |      | $\pm 100 \text{ nA}$        |
| $V_{CE(sat)}$ | $I_C = I_T$ , $V_{GE} = 15 \text{ V}$ , Note 1<br>$T_J = 125^\circ\text{C}$ |                                                                                 | 2.1  | 2.9 V<br>V                  |

| Symbol                    | Test Conditions                                                                                                                                                        | Characteristic Values                              |      |        |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------|--------|
|                           |                                                                                                                                                                        | (T <sub>J</sub> = 25°C unless otherwise specified) |      |        |
|                           |                                                                                                                                                                        | min.                                               | typ. | max.   |
| <b>g<sub>fs</sub></b>     | I <sub>C</sub> = I <sub>T</sub> ; V <sub>CE</sub> = 10 V,                                                                                                              | 18                                                 | 28   | S      |
| <b>C<sub>ies</sub></b>    | V <sub>CE</sub> = 25 V, V <sub>GE</sub> = 0 V, f = 1 MHz                                                                                                               |                                                    | 1790 | pF     |
| <b>C<sub>oes</sub></b>    |                                                                                                                                                                        |                                                    | 146  | pF     |
| <b>C<sub>res</sub></b>    |                                                                                                                                                                        |                                                    | 49   | pF     |
| <b>Q<sub>g</sub></b>      | I <sub>C</sub> = I <sub>T</sub> , V <sub>GE</sub> = 15 V, V <sub>CE</sub> = 0.5 V <sub>CES</sub>                                                                       |                                                    | 89   | nC     |
| <b>Q<sub>ge</sub></b>     |                                                                                                                                                                        |                                                    | 15   | nC     |
| <b>Q<sub>gc</sub></b>     |                                                                                                                                                                        |                                                    | 34   | nC     |
| <b>t<sub>d(on)</sub></b>  | Inductive load, T <sub>J</sub> = 25°C<br>I <sub>C</sub> = I <sub>T</sub> , V <sub>GE</sub> = 15 V<br>V <sub>CE</sub> = 720 V, R <sub>G</sub> = R <sub>off</sub> = 5 Ω  |                                                    | 20   | ns     |
| <b>t<sub>ri</sub></b>     |                                                                                                                                                                        |                                                    | 22   | ns     |
| <b>t<sub>d(off)</sub></b> |                                                                                                                                                                        |                                                    | 260  | ns     |
| <b>t<sub>fi</sub></b>     |                                                                                                                                                                        |                                                    | 150  | ns     |
| <b>E<sub>off</sub></b>    |                                                                                                                                                                        |                                                    | 2.2  | 4.5 mJ |
| <b>t<sub>d(on)</sub></b>  | Inductive load, T <sub>J</sub> = 125°C<br>I <sub>C</sub> = I <sub>T</sub> , V <sub>GE</sub> = 15 V<br>V <sub>CE</sub> = 720 V, R <sub>G</sub> = R <sub>off</sub> = 5 Ω |                                                    | 20   | ns     |
| <b>t<sub>ri</sub></b>     |                                                                                                                                                                        |                                                    | 22   | ns     |
| <b>E<sub>on</sub></b>     |                                                                                                                                                                        |                                                    | 3.8  | mJ     |
| <b>t<sub>d(off)</sub></b> |                                                                                                                                                                        |                                                    | 360  | ns     |
| <b>t<sub>fi</sub></b>     |                                                                                                                                                                        |                                                    | 330  | ns     |
| <b>E<sub>off</sub></b>    |                                                                                                                                                                        |                                                    | 5.75 | mJ     |
| <b>R<sub>thJC</sub></b>   |                                                                                                                                                                        |                                                    | 0.8  | KW     |
| <b>R<sub>thCS</sub></b>   |                                                                                                                                                                        | 0.15                                               |      | KW     |

## 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- COLLECTOR/CATHODE
- 3- EMITTER/ANODE
- 4- NO CONNECTION

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

## Ultrafast Diode

| Symbol                  | Conditions             | Maximum Ratings |   |
|-------------------------|------------------------|-----------------|---|
| <b>I<sub>FRMS</sub></b> |                        | 60              | A |
| <b>I<sub>F110</sub></b> | T <sub>C</sub> = 110°C | 22              | A |

| Symbol                  | Conditions                                                                      | Characteristic Values |      |        |
|-------------------------|---------------------------------------------------------------------------------|-----------------------|------|--------|
|                         |                                                                                 | min.                  | typ. | max.   |
| <b>V<sub>F</sub></b>    | I <sub>F</sub> = 30 A<br>T <sub>VJ</sub> = 125°C                                |                       | 1.8  | 2.75 V |
| <b>I<sub>RM</sub></b>   | I <sub>F</sub> = 50 A; di <sub>F</sub> /dt = -100 A/μs; T <sub>VJ</sub> = 100°C |                       | 5.5  | 11.4 A |
| <b>t<sub>rr</sub></b>   | V <sub>R</sub> = 100 V; V <sub>GE</sub> = 0 V                                   |                       | 190  | ns     |
| <b>R<sub>thJC</sub></b> |                                                                                 |                       | 1.1  | KW     |
| <b>R<sub>thCS</sub></b> |                                                                                 | 0.15                  |      | KW     |

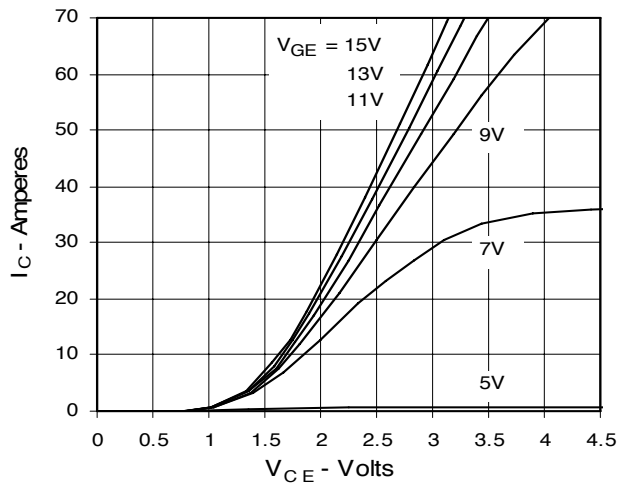
## Notes:

1. Pulse test: Pulse width < 300 μs, duty cycle < 2 %;
2. Test current I<sub>T</sub> = 32 A.

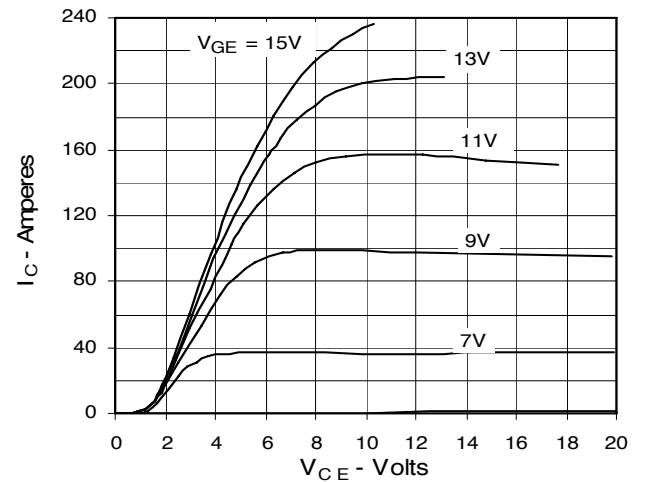
IXYS reserves the right to change limits, test conditions, and dimensions.

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

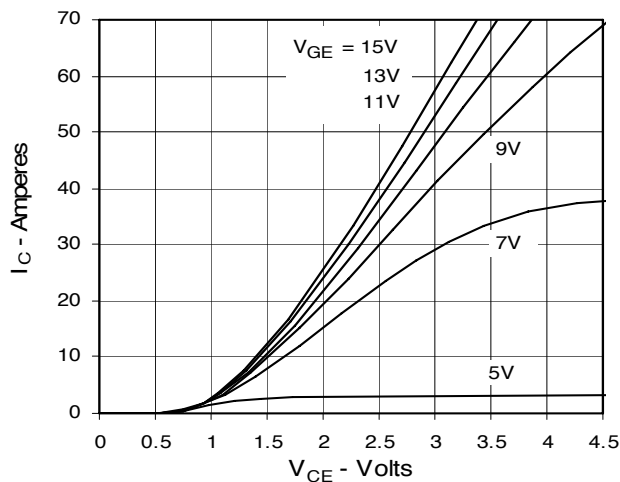
**Fig. 1. Output Characteristics**  
@ 25 °C



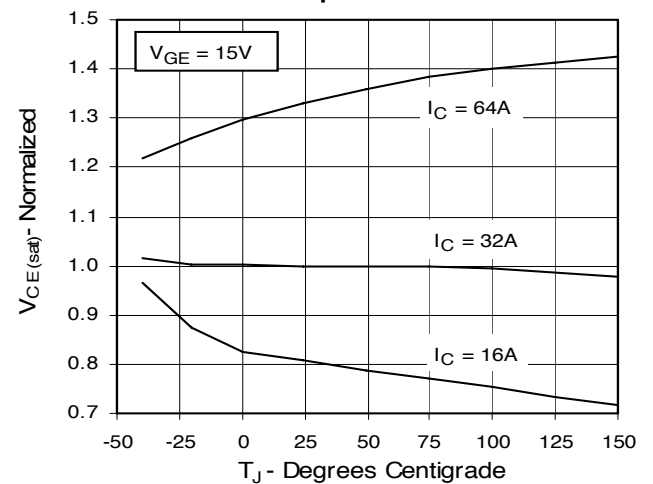
**Fig. 2. Extended Output Characteristics**  
@ 25 °C



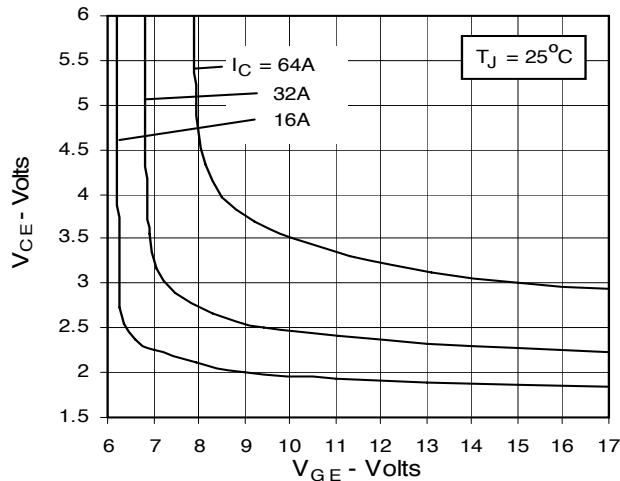
**Fig. 3. Output Characteristics**  
@ 125 °C



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



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



**Fig. 6. Input Admittance**

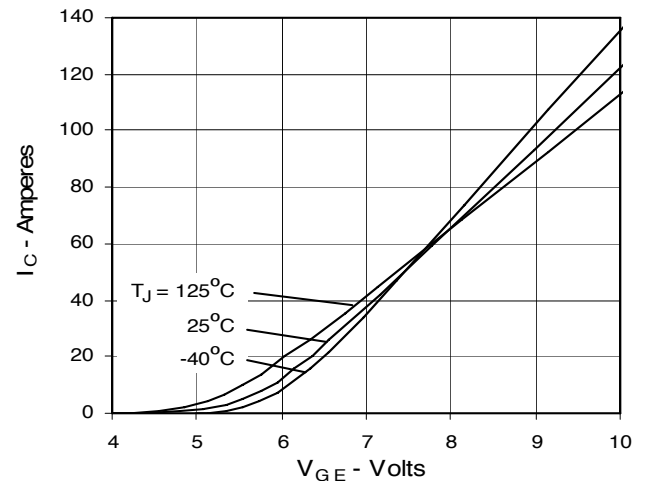


Fig. 7. Transconductance

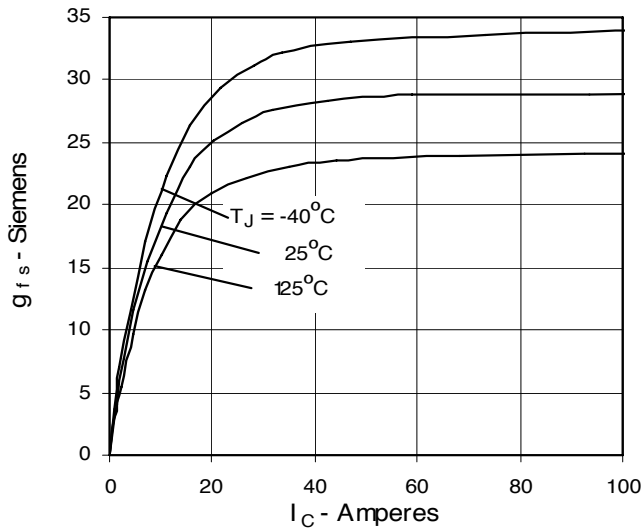


Fig. 8. Gate Charge

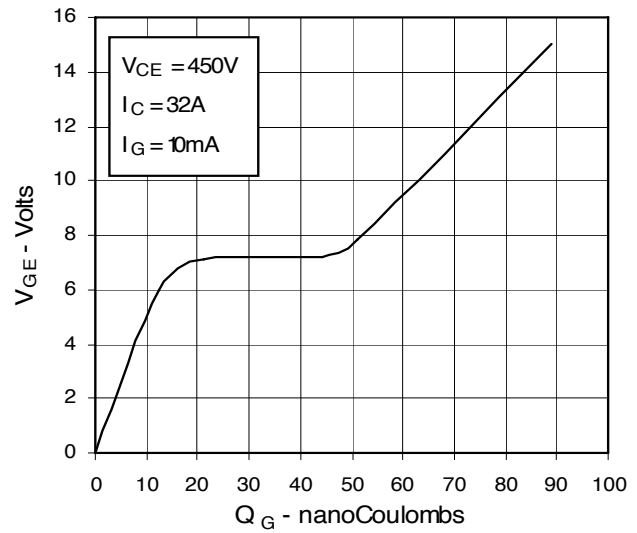


Fig. 9. Capacitance

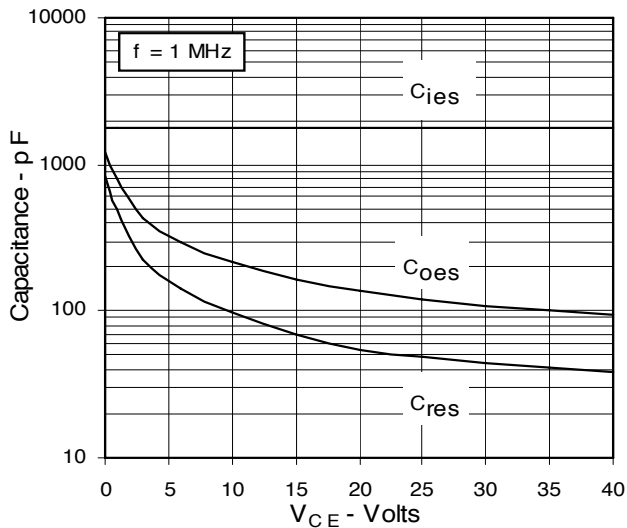


Fig. 10. Reverse-Bias Safe Operating Area

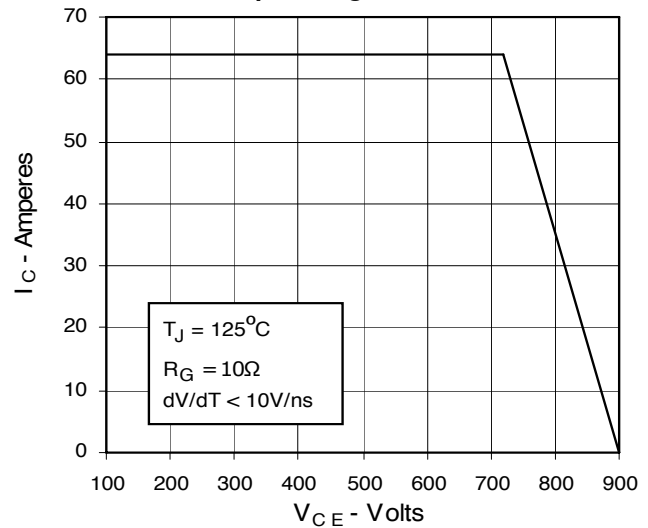
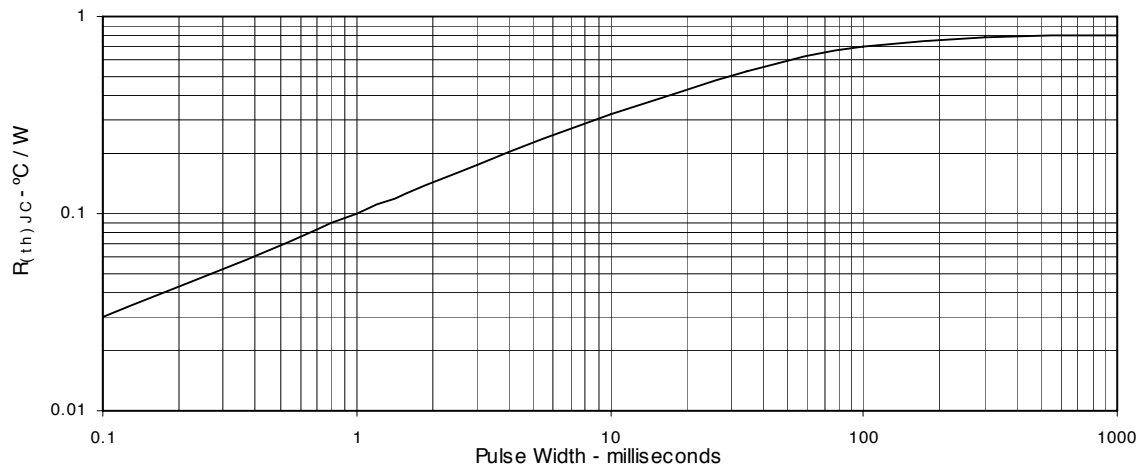


Fig. 11. Maximum Transient Thermal Resistance

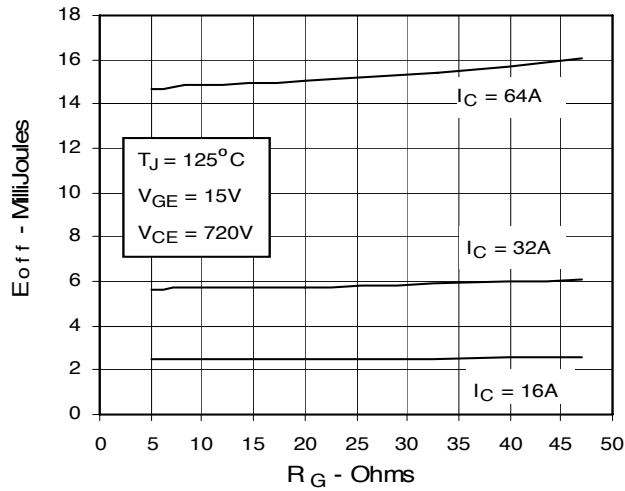


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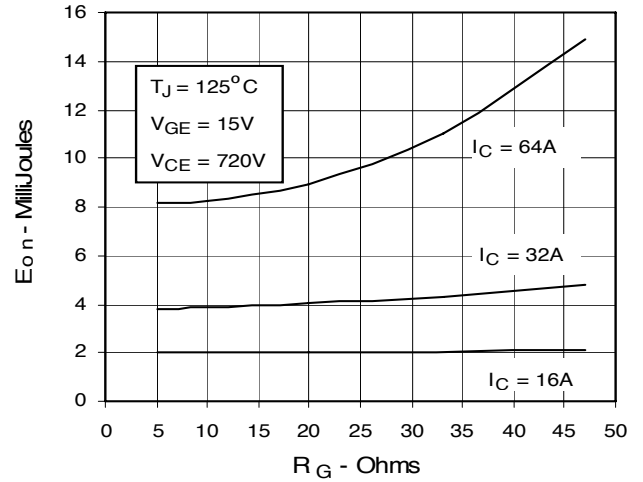
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|           |           |           |           |              |              |              |              |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|
| 4,835,592 | 4,931,844 | 5,049,961 | 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 |

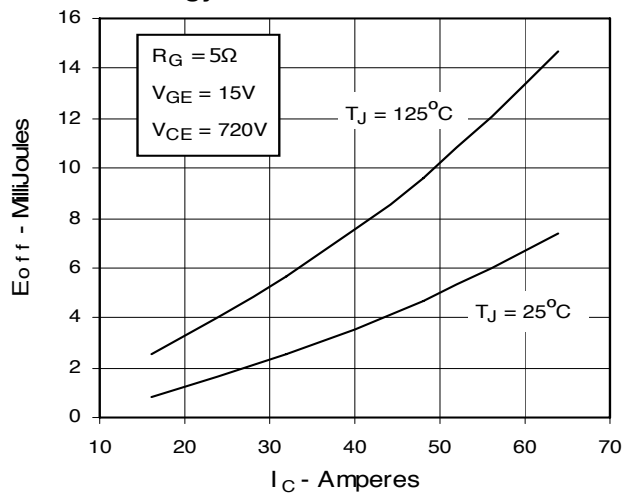
**Fig. 12. Dependence of Turn-off Energy Loss on Gate Resistance**



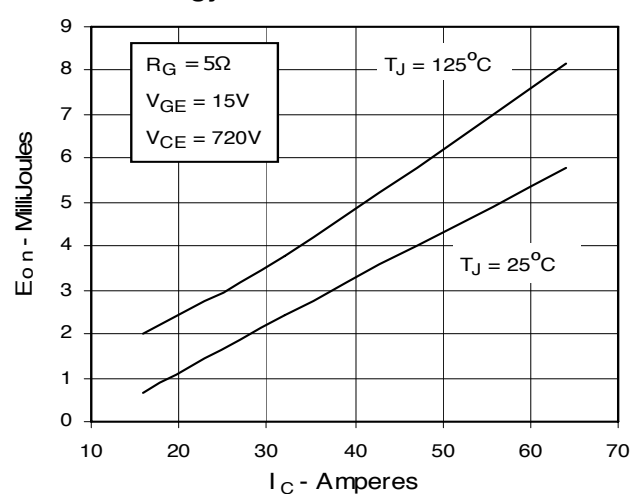
**Fig. 13. Dependence of Turn-on Energy Loss on Gate Resistance**



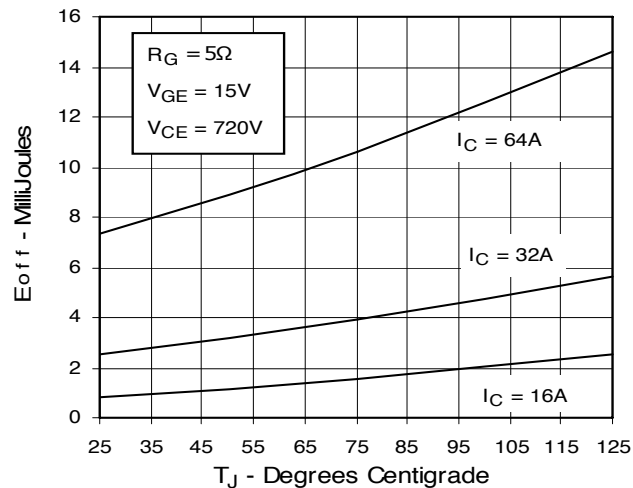
**Fig. 14. Dependence of Turn-off Energy Loss on Collector Current**



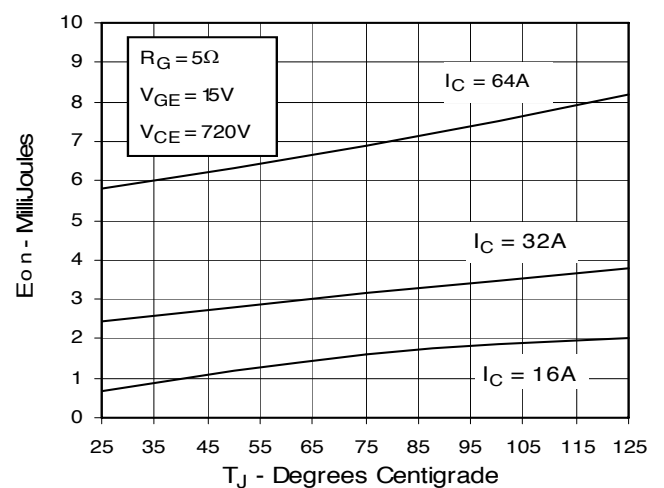
**Fig. 15. Dependence of Turn-on Energy Loss on Collector Current**



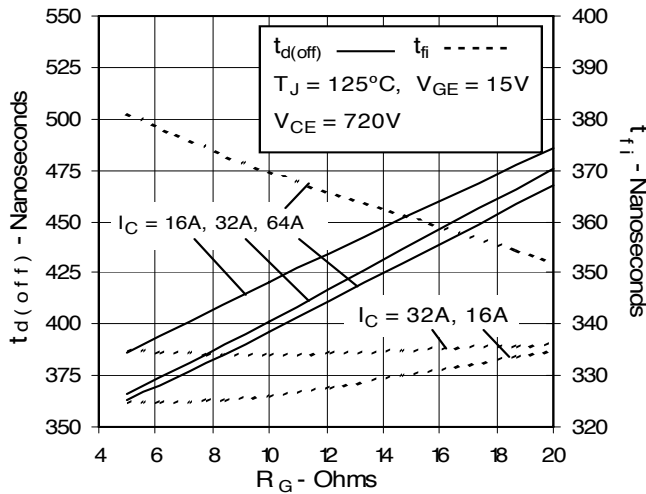
**Fig. 16. Dependence of Turn-off Energy Loss on Temperature**



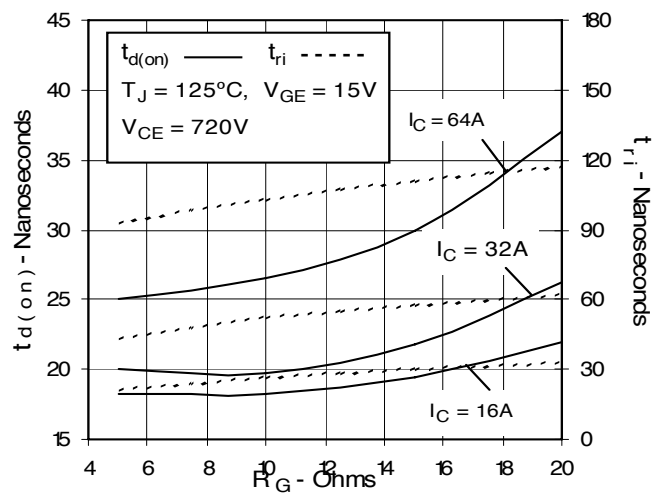
**Fig. 17. Dependence of Turn-on Energy Loss on Temperature**



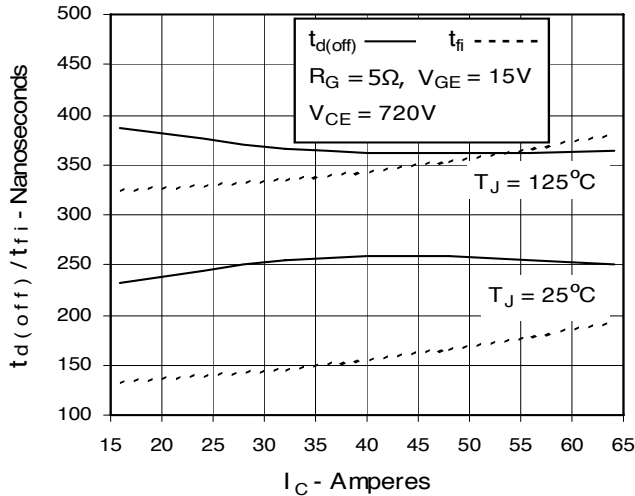
**Fig. 18. Dependence of Turn-off Switching Time on Gate Resistance**



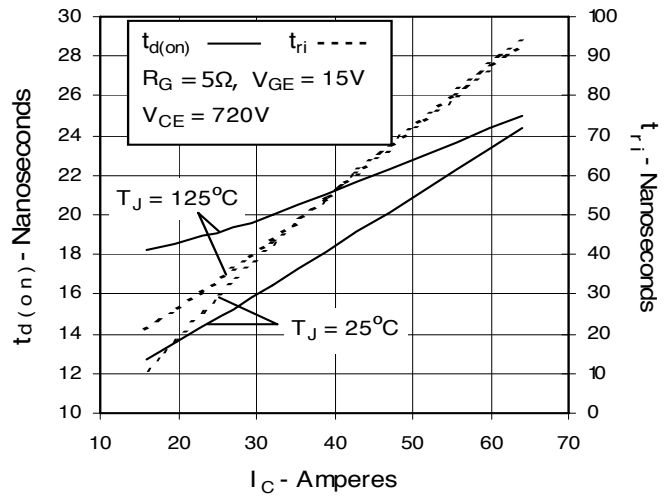
**Fig. 19. Dependence of Turn-on Switching Time on Gate Resistance**



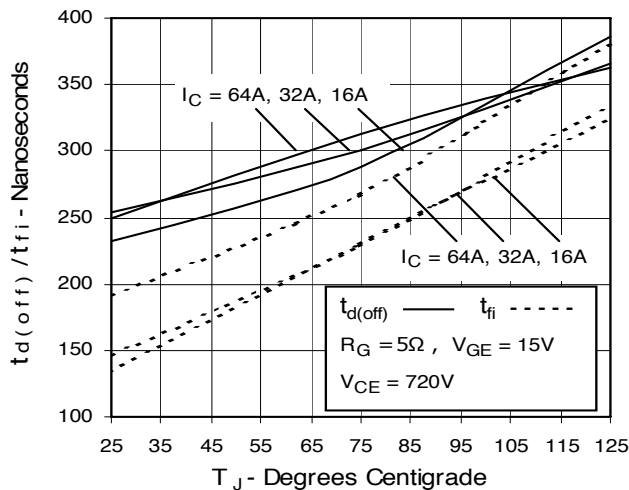
**Fig. 20. Dependence of Turn-off Switching Time on Collector Current**



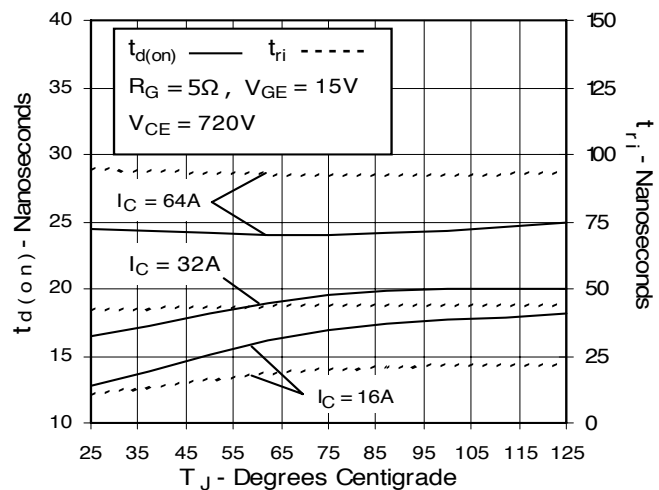
**Fig. 21. Dependence of Turn-on Switching Time on Collector Current**



**Fig. 22. Dependence of Turn-off Switching Time on Temperature**



**Fig. 23. Dependence of Turn-on Switching Time on Temperature**



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

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

## Ultrafast Diode Characteristics

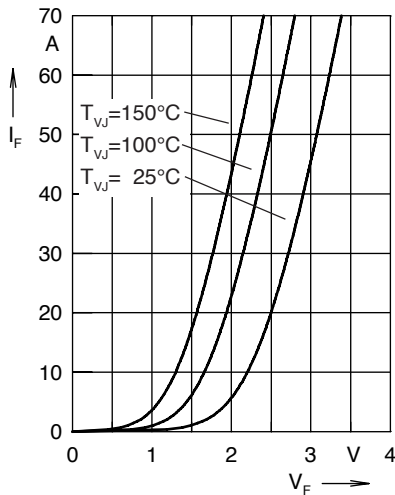


Fig. 24. Forward current  $I_F$  versus  $V_F$

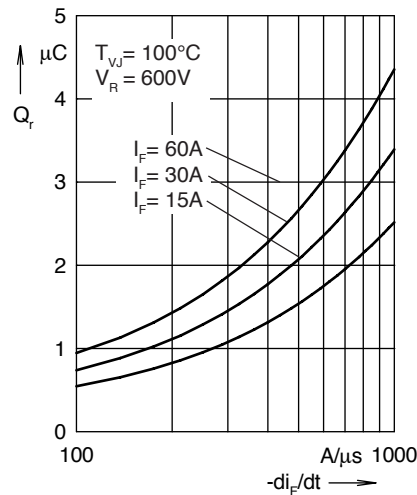


Fig. 25. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

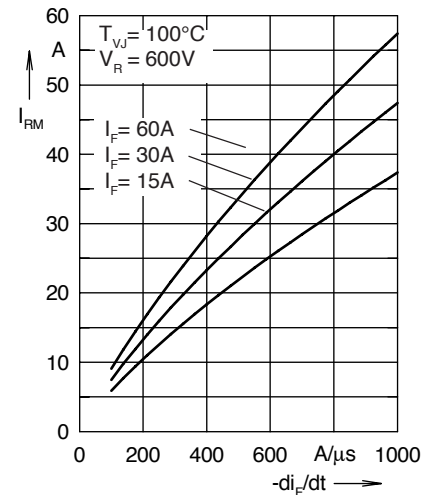


Fig. 26. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

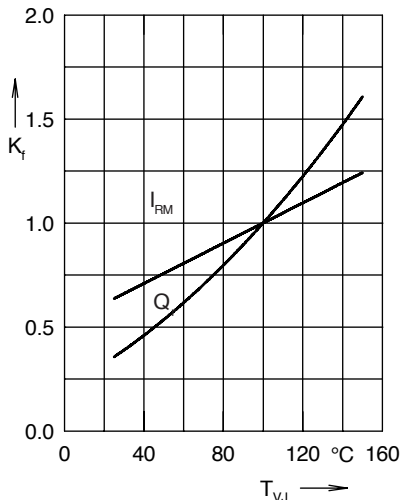


Fig. 27. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

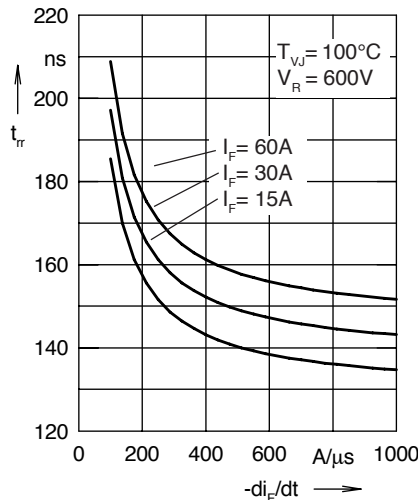


Fig. 28. Recovery time  $t_{rr}$  versus  $-di_F/dt$

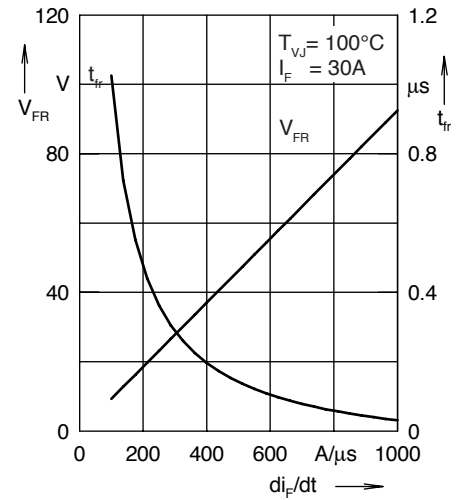


Fig. 29. Peak forward voltage  $V_{FR}$  and  $t_{rr}$  versus  $di_F/dt$

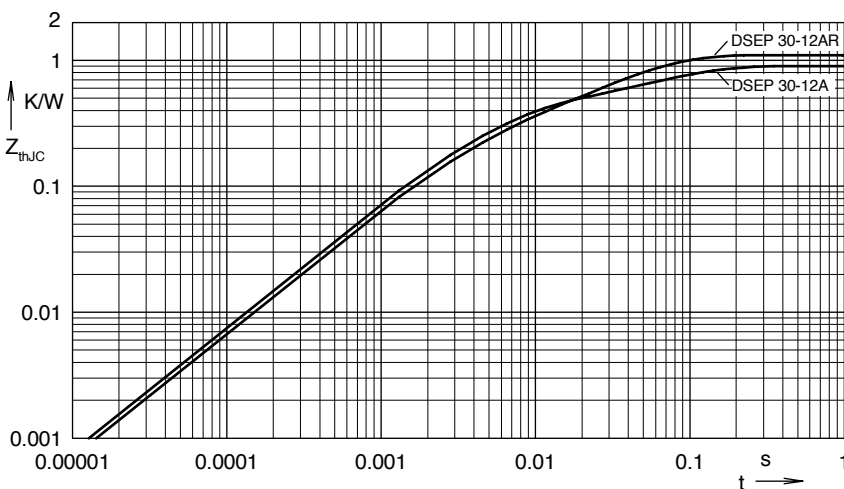


Fig. 30. Transient thermal resistance junction-to-case

Constants for  $Z_{thJC}$  calculation for non-isolated diode (DSEP 30-12A):

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|-----------------|-----------|
| 1 | 0.465           | 0.0052    |
| 2 | 0.179           | 0.0003    |
| 3 | 0.256           | 0.0397    |

Constants for  $Z_{thJC}$  calculation for isolated diode (DSEP 30-12AR):

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|-----------------|-----------|
| 1 | 0.368           | 0.0052    |
| 2 | 0.1417          | 0.0003    |
| 3 | 0.0295          | 0.0004    |
| 4 | 0.5604          | 0.0092    |

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