

# TrenchMV™ Power MOSFET

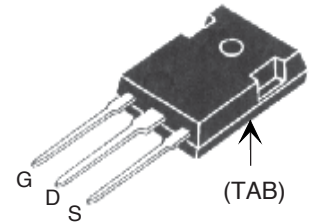
**IXTH220N075T**  
**IXTQ220N075T**

$V_{DSS} = 75 \text{ V}$   
 $I_{D25} = 220 \text{ A}$   
 $R_{DS(on)} \leq 4.5 \text{ m}\Omega$

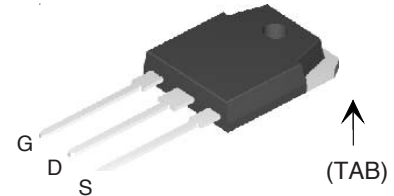
N-Channel Enhancement Mode  
Avalanche Rated



TO-247 (IXTH)



TO-3P (IXTQ)



G = Gate      D = Drain  
S = Source    TAB = Drain

| Symbol     | Test Conditions   | Maximum Ratings |                  |
|------------|---|-----------------|------------------|
| $V_{DSS}$  | $T_J = 25^\circ\text{C}$ to $175^\circ\text{C}$   | 75              | V                |
| $V_{DGR}$  | $T_J = 25^\circ\text{C}$ to $175^\circ\text{C}$ ; $R_{GS} = 1 \text{ M}\Omega$  | 75              | V                |
| $V_{GSM}$  | Transient   | $\pm 20$        | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$  | 220             | A                |
| $I_{LRMS}$ | Lead Current Limit, RMS   | 75              | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$  | 600             | A                |
| $I_{AR}$   | $T_C = 25^\circ\text{C}$  | 25              | A                |
| $E_{AS}$   | $T_C = 25^\circ\text{C}$  | 1.0             | J                |
| $dv/dt$    | $I_S \leq I_{DM}$ , $di/dt \leq 100 \text{ A}/\mu\text{s}$ , $V_{DD} \leq V_{DSS}$<br>$T_J \leq 175^\circ\text{C}$ , $R_G = 3.3 \Omega$ | 3               | V/ns             |
| $P_D$      | $T_C = 25^\circ\text{C}$  | 480             | W                |
| $T_J$      |   | -55 ... +175    | $^\circ\text{C}$ |
| $T_{JM}$   |   | 175             | $^\circ\text{C}$ |
| $T_{stg}$  |   | -55 ... +175    | $^\circ\text{C}$ |
| $T_L$      | 1.6 mm (0.062 in.) from case for 10 s   | 300             | $^\circ\text{C}$ |
| $T_{SOLD}$ | Plastic body for 10 seconds   | 260             | $^\circ\text{C}$ |
| $M_d$      | Mounting torque   | 1.13 / 10       | Nm/lb.in.        |
| Weight     | TO-3P   | 5.5             | g                |
|            | TO-247  | 6               | g                |

### Features

- Ultra-low On Resistance
- Unclamped Inductive Switching (UIS) rated
- Low package inductance
  - easy to drive and to protect
- 175  $^\circ\text{C}$  Operating Temperature

### Advantages

- Easy to mount
- Space savings
- High power density

### Applications

- Automotive
  - Motor Drives
  - 42V Power Bus
  - ABS Systems
- DC/DC Converters and Off-line UPS
- Primary Switch for 24V and 48V Systems
- High Current Switching Applications

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ unless otherwise specified) | Characteristic Values |      |                      |
|--------------|---|-----------------------|------|----------------------|
|              |   | Min.                  | Typ. | Max.                 |
| $BV_{DSS}$   | $V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$                          | 75                    |      | V                    |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$                               | 2.0                   |      | V                    |
| $I_{GSS}$    | $V_{GS} = \pm 20 \text{ V}$ , $V_{DS} = 0 \text{ V}$                      |                       |      | $\pm 200 \text{ nA}$ |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$<br>$V_{GS} = 0 \text{ V}$<br>$T_J = 150^\circ\text{C}$ |                       |      | 5 $\mu\text{A}$      |
|              |   |                       |      | 250 $\mu\text{A}$    |
| $R_{DS(on)}$ | $V_{GS} = 10 \text{ V}$ , $I_D = 25 \text{ A}$ , Notes 1, 2               | 3.6                   | 4.5  | $\text{m}\Omega$     |

| Symbol  | Test Conditions   | Characteristic Values |      |                        |
|---|---|-----------------------|------|------------------------|
|   |   | Min.                  | Typ. | Max.                   |
| $(T_J = 25^\circ\text{C unless otherwise specified})$ |   |                       |      |                        |
| $g_{fs}$  | $V_{DS} = 10\text{ V}; I_D = 60\text{ A, Note 1}$               | 75                    | 120  | S                      |
| $C_{iss}$   |   |                       | 7700 | pF                     |
| $C_{oss}$   | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$   |                       | 1100 | pF                     |
| $C_{rss}$   |   |                       | 230  | pF                     |
| <b>Resistive Switching Times</b>                      |   |                       |      |                        |
| $t_{d(on)}$   |   |                       | 29   | ns                     |
| $t_r$   | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 V_{DSS}, I_D = 25\text{ A}$ |                       | 65   | ns                     |
| $t_{d(off)}$  | $R_G = 3.3\ \Omega$ (External)                                  |                       | 55   | ns                     |
| $t_f$   |   |                       | 47   | ns                     |
| $Q_{g(on)}$   |   |                       | 165  | nC                     |
| $Q_{gs}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 V_{DSS}, I_D = 25\text{ A}$ |                       | 40   | nC                     |
| $Q_{gd}$  |   |                       | 50   | nC                     |
| $R_{thJC}$  |   |                       |      | $0.31^\circ\text{C/W}$ |
| $R_{thCH}$  |   | 0.25                  |      | $^\circ\text{C/W}$     |

### Source-Drain Diode

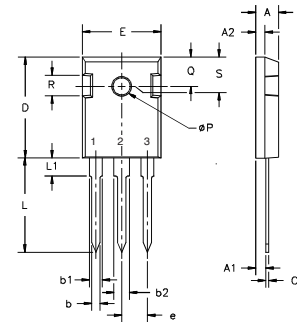
| Symbol  | Test Conditions  | Characteristic Values |      |       |
|---|--|-----------------------|------|-------|
|   |  | Min.                  | Typ. | Max.  |
| $T_J = 25^\circ\text{C unless otherwise specified}$ |  |                       |      |       |
| $I_S$   | $V_{GS} = 0\text{ V}$  |                       |      | 220 A |
| $I_{SM}$  | Pulse width limited by $T_{JM}$  |                       |      | 600 A |
| $V_{SD}$  | $I_F = 25\text{ A}, V_{GS} = 0\text{ V, Note 1}$   |                       |      | 1.0 V |
| $t_{rr}$  | $I_F = 25\text{ A}, -di/dt = 100\text{ A}/\mu\text{s}$<br>$V_R = 40\text{ V}, V_{GS} = 0\text{ V}$ |                       | 80   | ns    |

- Notes: 1. Pulse test,  $t \leq 300\ \mu\text{s}$ , duty cycle  $d \leq 2\%$ ;  
2. On through-hole packages,  $R_{DS(on)}$  Kelvin test contact location must be 5 mm or less from the package body.

### PRELIMINARY TECHNICAL INFORMATION

The product presented herein is under development. The Technical Specifications offered are derived from data gathered during objective characterizations of preliminary engineering lots; but also may yet contain some information supplied during a pre-production design evaluation. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

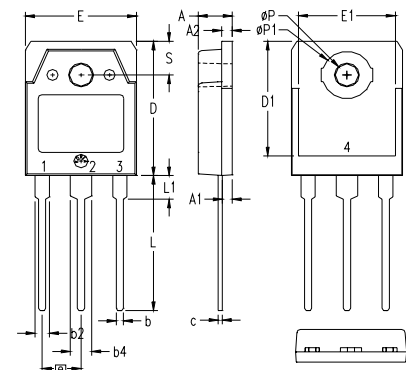
### TO-247 AD Outline



Terminals: 1 - Gate 2 - Drain  
3 - Source Tab - Drain

| Dim.           | Millimeter |       | Inches |       |
|----------------|------------|-------|--------|-------|
|                | Min.       | Max.  | Min.   | Max.  |
| A              | 4.7        | 5.3   | .185   | .209  |
| A <sub>1</sub> | 2.2        | 2.54  | .087   | .102  |
| A <sub>2</sub> | 2.2        | 2.6   | .059   | .098  |
| b              | 1.0        | 1.4   | .040   | .055  |
| b <sub>1</sub> | 1.65       | 2.13  | .065   | .084  |
| b <sub>2</sub> | 2.87       | 3.12  | .113   | .123  |
| C              | .4         | .8    | .016   | .031  |
| D              | 20.80      | 21.46 | .819   | .845  |
| E              | 15.75      | 16.26 | .610   | .640  |
| e              | 5.20       | 5.72  | 0.205  | 0.225 |
| L              | 19.81      | 20.32 | .780   | .800  |
| L1             |            | 4.50  |        | .177  |
| ∅P             | 3.55       | 3.65  | .140   | .144  |
| Q              | 5.89       | 6.40  | 0.232  | 0.252 |
| R              | 4.32       | 5.49  | .170   | .216  |
| S              | 6.15       | BSC   | 242    | BSC   |

### TO-3P (IXTQ) Outline



Pins: 1 - Gate 2 - Drain  
3 - Source 4, TAB - Drain

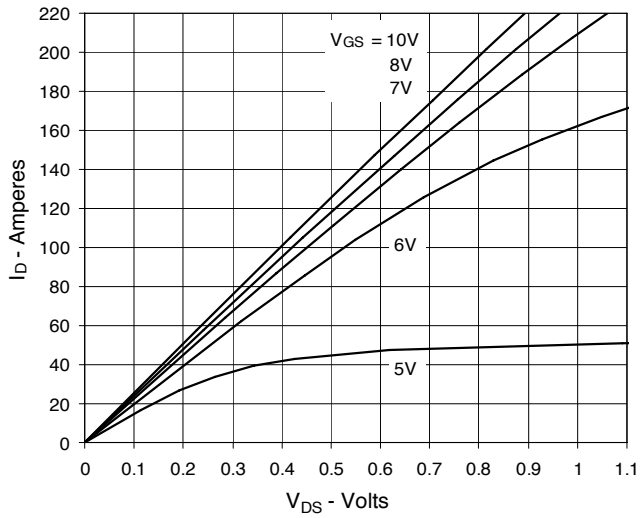
| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .185     | .193 | 4.70        | 4.90  |
| A1  | .051     | .059 | 1.30        | 1.50  |
| A2  | .057     | .065 | 1.45        | 1.65  |
| b   | .035     | .045 | 0.90        | 1.15  |
| b2  | .075     | .087 | 1.90        | 2.20  |
| b4  | .114     | .126 | 2.90        | 3.20  |
| c   | .022     | .031 | 0.55        | 0.80  |
| D   | .780     | .791 | 19.80       | 20.10 |
| D1  | .665     | .677 | 16.90       | 17.20 |
| E   | .610     | .622 | 15.50       | 15.80 |
| E1  | .531     | .539 | 13.50       | 13.70 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .779     | .795 | 19.80       | 20.20 |
| L1  | .134     | .142 | 3.40        | 3.60  |
| ∅P  | .126     | .134 | 3.20        | 3.40  |
| ∅P1 | .272     | .280 | 6.90        | 7.10  |
| S   | .193     | .201 | 4.90        | 5.10  |

All metal area are tin plated.

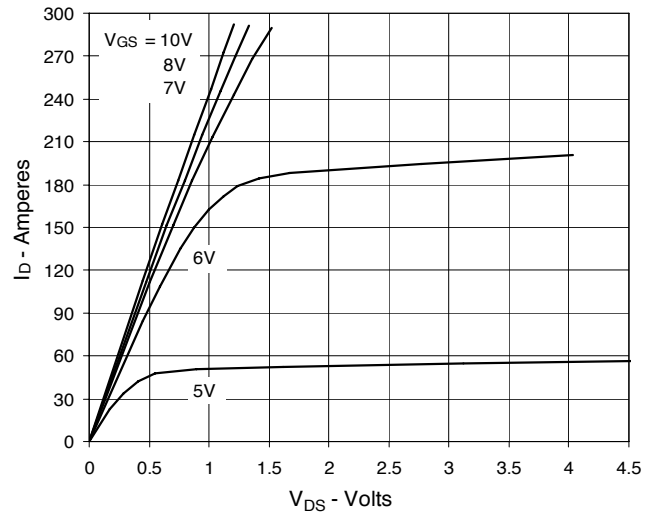
IXYS reserves the right to change limits, test conditions, and dimensions.

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

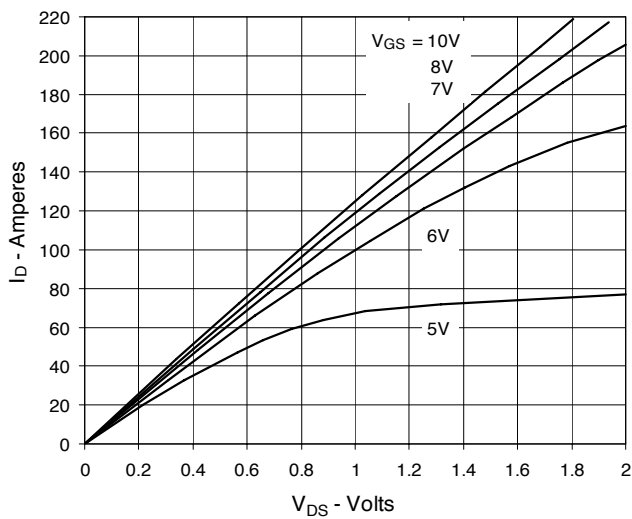
**Fig. 1. Output Characteristics @ 25°C**



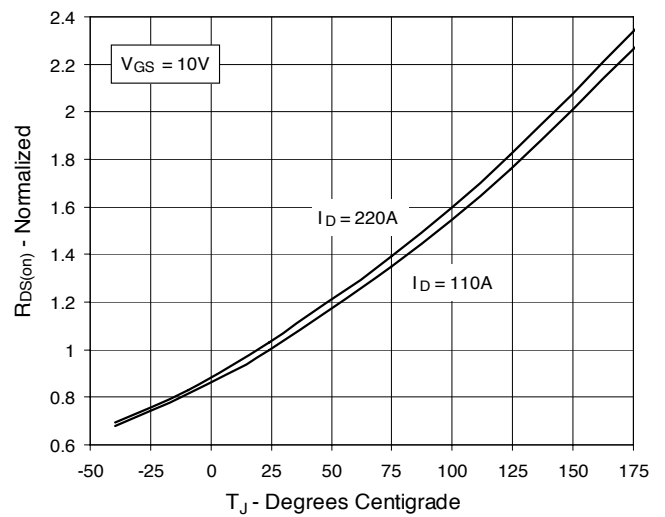
**Fig. 2. Extended Output Characteristics @ 25°C**



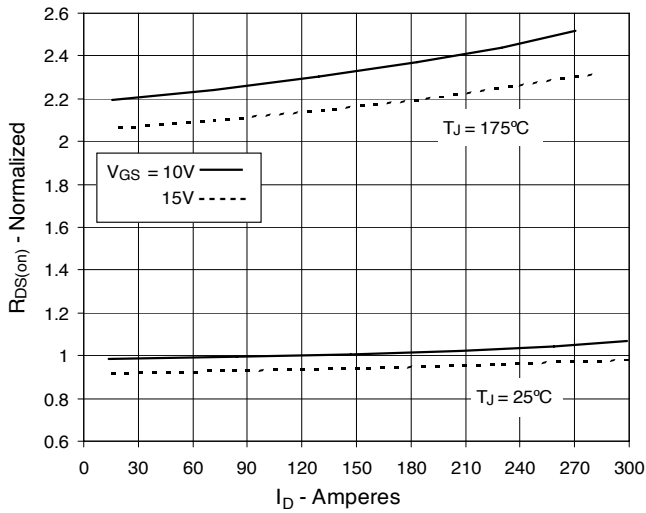
**Fig. 3. Output Characteristics @ 150°C**



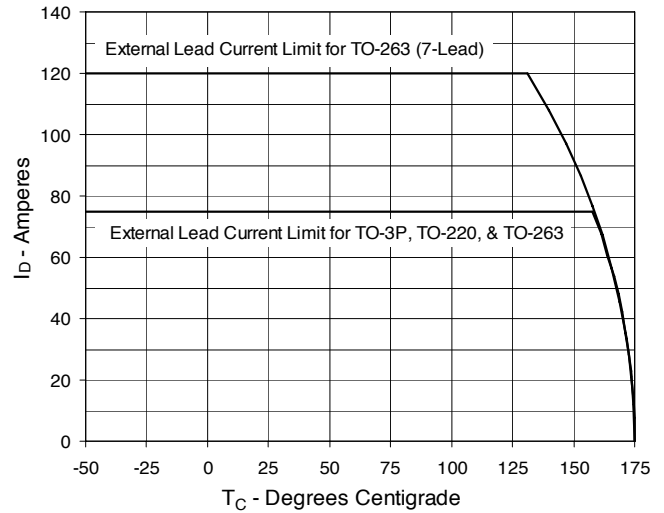
**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 110A$  Value vs. Junction Temperature**



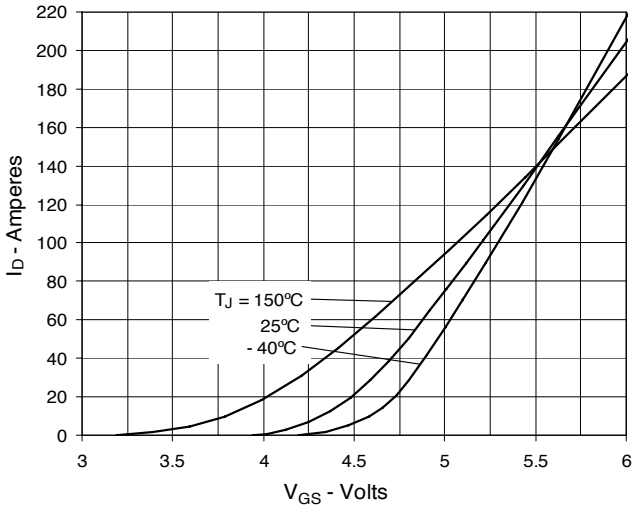
**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 110A$  Value vs. Drain Current**



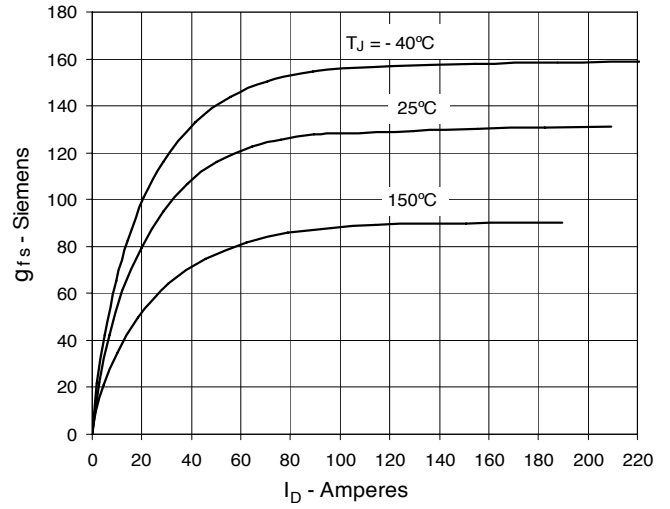
**Fig. 6. Drain Current vs. Case Temperature**



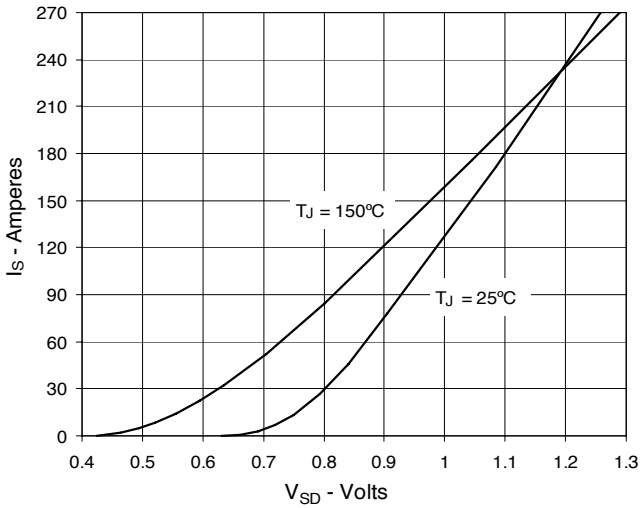
**Fig. 7. Input Admittance**



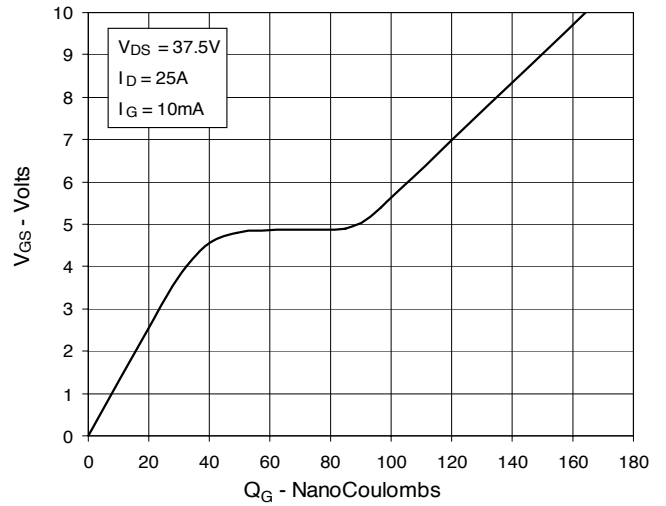
**Fig. 8. Transconductance**



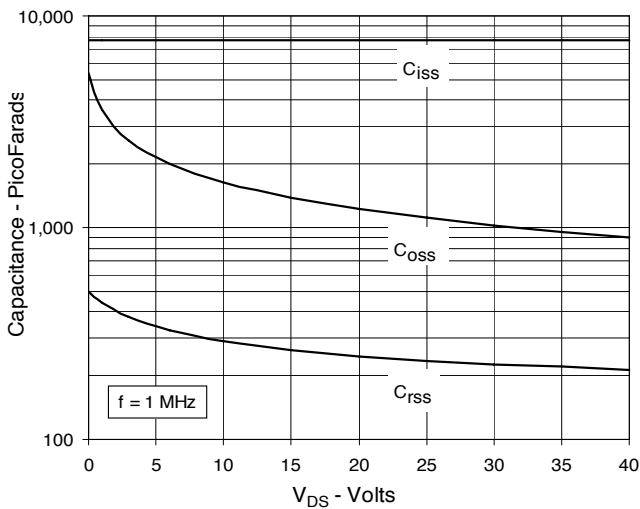
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



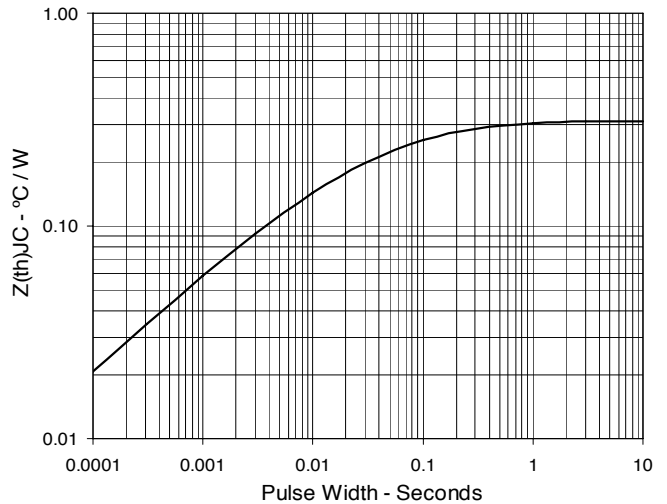
**Fig. 10. Gate Charge**



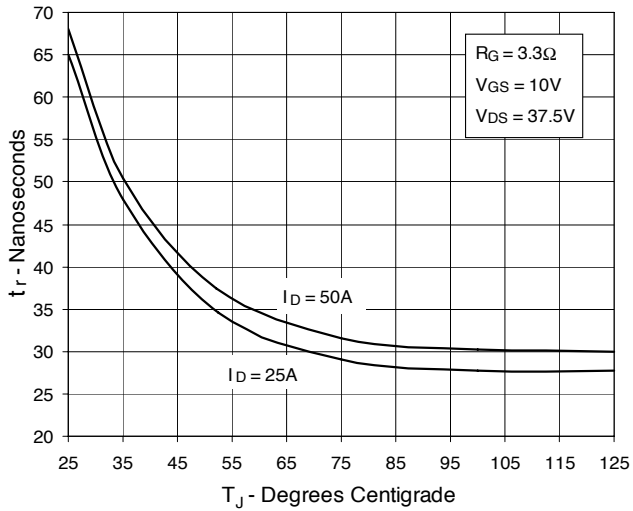
**Fig. 11. Capacitance**



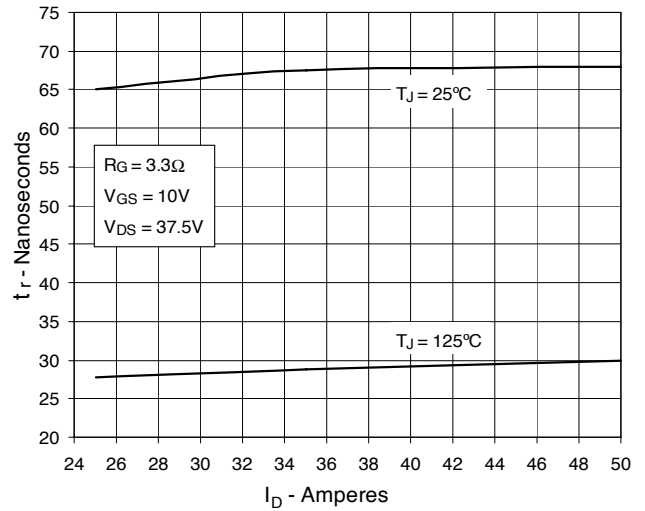
**Fig. 12. Maximum Transient Thermal Impedance**



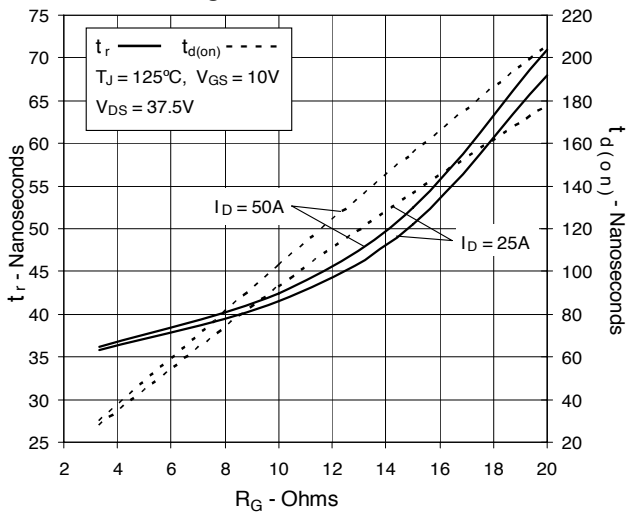
**Fig. 13. Resistive Turn-on Rise Time vs. Junction Temperature**



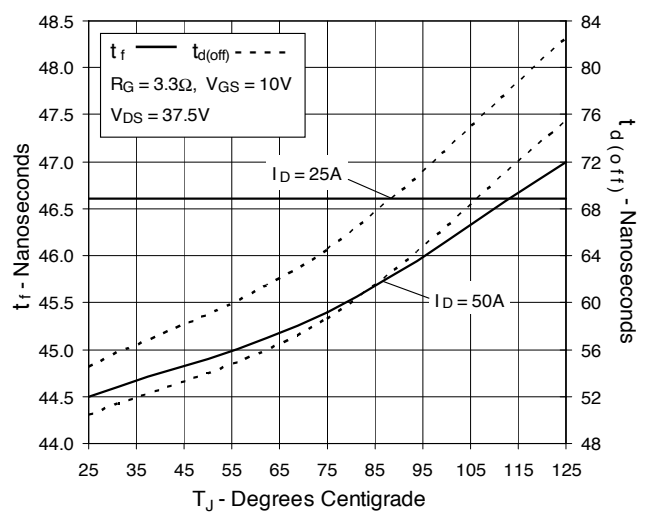
**Fig. 14. Resistive Turn-on Rise Time vs. Drain Current**



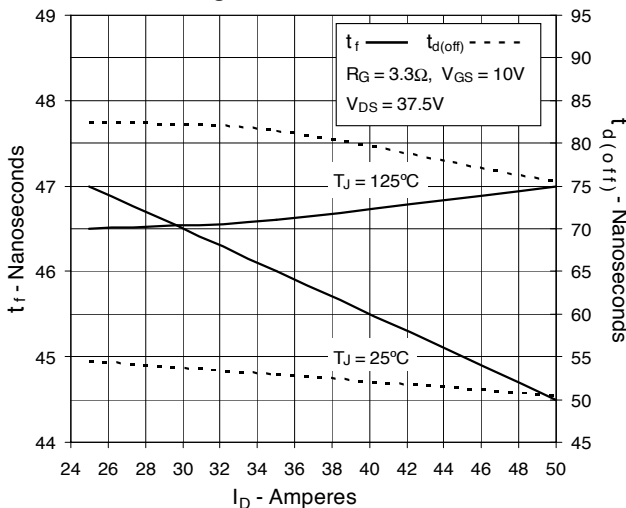
**Fig. 15. Resistive Turn-on Switching Times vs. Gate Resistance**



**Fig. 16. Resistive Turn-off Switching Times vs. Junction Temperature**



**Fig. 17. Resistive Turn-off Switching Times vs. Drain Current**



**Fig. 18. Resistive Turn-off Switching Times vs. Gate Resistance**

