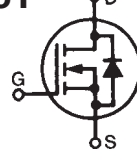


### Trench Gate Power MOSFET

N-Channel Enhancement Mode  
Avalanche Rated

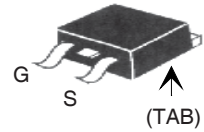
IXTA90N15T  
IXTH90N15T  
IXTP90N15T  
IXTQ90N15T



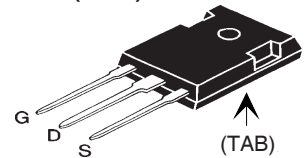
$$\begin{aligned} V_{DSS} &= 150V \\ I_{D25} &= 90A \\ R_{DS(on)} &\leq 20m\Omega \end{aligned}$$

| Symbol     | Test Conditions                                                          | Maximum Ratings  |     |                  |
|------------|--------------------------------------------------------------------------|------------------|-----|------------------|
| $V_{DSS}$  | $T_J = 25^\circ\text{C}$ to $175^\circ\text{C}$                          | 150              |     | V                |
| $V_{DGR}$  | $T_J = 25^\circ\text{C}$ to $175^\circ\text{C}$ , $R_{GS} = 1M\Omega$    | 150              |     | V                |
| $V_{GSM}$  |                                                                          | $\pm 30$         |     | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$ *                                               | 90               |     | A                |
| $I_{LRMS}$ | Lead Current Limit, RMS                                                  | 75               |     | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$               | 250              |     | A                |
| $I_A$      | $T_C = 25^\circ\text{C}$                                                 | 4                |     | A                |
| $E_{AS}$   | $T_C = 25^\circ\text{C}$                                                 | 750              |     | $\mu\text{J}$    |
| $dV/dt$    | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 175^\circ\text{C}$ | 10               |     | V/ns             |
| $P_D$      | $T_C = 25^\circ\text{C}$                                                 | 455              |     | W                |
| $T_J$      |                                                                          | -55 ... +175     |     | $^\circ\text{C}$ |
| $T_{JM}$   |                                                                          | 175              |     | $^\circ\text{C}$ |
| $T_{stg}$  |                                                                          | -55 ... +175     |     | $^\circ\text{C}$ |
| $T_L$      | 1.6mm (0.062 in.) from case for 10s                                      | 300              |     | $^\circ\text{C}$ |
| $T_{SOLD}$ | Plastic body for 10 seconds                                              | 260              |     | $^\circ\text{C}$ |
| $M_d$      | Mounting Torque(TO-220,TO-3P,TO-247)                                     | 1.13/10          |     | Nm/lb.in.        |
| $F_c$      | Mounting Force (TO-263)                                                  | 10..65/2.2..14.6 |     | N/lb.            |
| Weight     |                                                                          | TO-263           | 2.5 | g                |
|            |                                                                          | TO-220           | 3   | g                |
|            |                                                                          | TO-3P            | 5.5 | g                |
|            |                                                                          | TO-247           | 6   | g                |

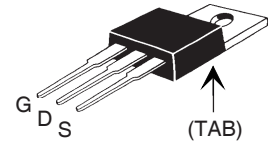
TO-263



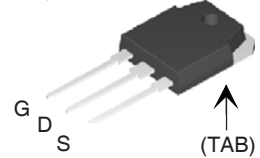
TO-247 (IXTH)



TO-220 (IXTP)



TO-3P (IXTQ)



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

#### Features

- International standard packages
- Unclamped Inductive Switching (UIS) rated
- Low package inductance
  - easy to drive and to protect

#### Applications

- DC-DC converters
- Battery chargers
- Switched-mode and resonant-mode power supplies
- DC choppers
- AC motor control
- Uninterruptible power supplies

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) | Characteristic Values |      |                                      |
|--------------|-----------------------------------------------------------------------------|-----------------------|------|--------------------------------------|
|              |                                                                             | Min.                  | Typ. | Max.                                 |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 250\mu\text{A}$                                      | 150                   |      | V                                    |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 1\text{mA}$                                      | 2.5                   |      | 4.5 V                                |
| $I_{GSS}$    | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$                                          |                       |      | $\pm 200$ nA                         |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$<br>$V_{GS} = 0V$ $T_J = 150^\circ\text{C}$               |                       |      | 5 $\mu\text{A}$<br>250 $\mu\text{A}$ |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                         | 17                    | 20   | m $\Omega$                           |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ unless otherwise specified)                                                                            | Characteristic Values |      |                         |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|              |                                                                                                                                                      | Min.                  | Typ. | Max.                    |
| $g_{fs}$     | $V_{DS} = 10\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                                                                                           | 40                    | 69   | S                       |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                     |                       | 4100 | pF                      |
| $C_{oss}$    |                                                                                                                                                      |                       | 560  | pF                      |
| $C_{rss}$    |                                                                                                                                                      |                       | 92   | pF                      |
| $t_{d(on)}$  | <b>Resistive Switching Times</b><br>$V_{GS} = 15\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$<br>$R_G = 3.3\Omega$ (External) |                       | 24   | ns                      |
| $t_r$        |                                                                                                                                                      |                       | 22   | ns                      |
| $t_{d(off)}$ |                                                                                                                                                      |                       | 44   | ns                      |
| $t_f$        |                                                                                                                                                      |                       | 19   | ns                      |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 25\text{A}$                                                                            |                       | 80   | nC                      |
| $Q_{gs}$     |                                                                                                                                                      |                       | 20   | nC                      |
| $Q_{gd}$     |                                                                                                                                                      |                       | 20   | nC                      |
| $R_{thJC}$   |                                                                                                                                                      |                       |      | 0.33 $^\circ\text{C/W}$ |
| $R_{thCH}$   | TO-220                                                                                                                                               | 0.25                  |      | $^\circ\text{C/W}$      |
|              | TO-3P, TO-263, TO-247                                                                                                                                | 0.21                  |      | $^\circ\text{C/W}$      |

#### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified)                          | Characteristic Values |      |       |
|----------|------------------------------------------------------------------------------------------------------|-----------------------|------|-------|
|          |                                                                                                      | Min.                  | Typ. | Max.  |
| $I_S$    | $V_{GS} = 0\text{V}$                                                                                 |                       |      | 90 A  |
| $I_{SM}$ | Repetitive                                                                                           |                       |      | 300 A |
| $V_{SD}$ | $I_F = 50\text{A}$ , $V_{GS} = 0\text{V}$ , Note 1                                                   |                       |      | 1.2 V |
| $t_{rr}$ | $I_F = 45\text{A}$ , $-di/dt = 250\text{A}/\mu\text{s}$<br>$V_R = 75\text{V}$ , $V_{GS} = 0\text{V}$ | 110                   |      | ns    |

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

\*: Current may be limited by external terminal current limit.

#### PRELIMINARY TECHNICAL INFORMATION

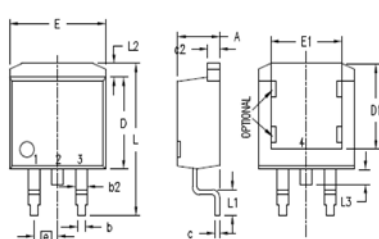
The product presented herein is under development. The Technical Specifications offered are derived from data gathered during objective characterizations of preliminary engineering lots; but also may yet contain some information supplied during a pre-production design evaluation. IXYS reserves the right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

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    |             |

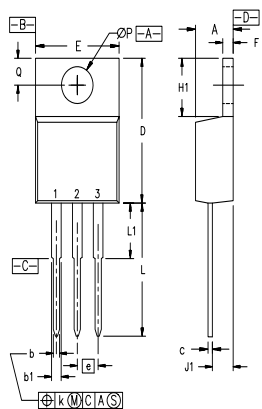
## TO-263 (IXTA) Outline



1. GATE
  2. DRAIN (COLLECTOR)
  3. SOURCE (EMITTER)
  4. DRAIN (COLLECTOR)
- BOTTOM SIDE

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .160     | .190 | 4.06        | 4.83  |
| A1  | .080     | .110 | 2.03        | 2.79  |
| b   | .020     | .039 | 0.51        | 0.99  |
| b2  | .045     | .055 | 1.14        | 1.40  |
| c   | .016     | .029 | 0.40        | 0.74  |
| c2  | .045     | .055 | 1.14        | 1.40  |
| D   | .340     | .380 | 8.64        | 9.65  |
| D1  | .315     | .350 | 8.00        | 8.89  |
| E   | .380     | .410 | 9.65        | 10.41 |
| E1  | .245     | .320 | 6.22        | 8.13  |
| e   | .100 BSC |      | 2.54 BSC    |       |
| L   | .575     | .625 | 14.61       | 15.88 |
| L1  | .090     | .110 | 2.29        | 2.79  |
| L2  | .040     | .055 | 1.02        | 1.40  |
| L3  | .050     | .070 | 1.27        | 1.78  |
| L4  | 0        | .005 | 0           | 0.13  |

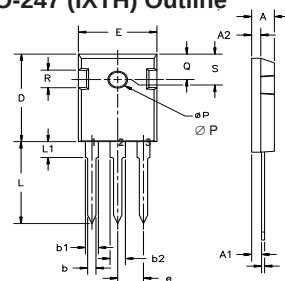
## TO-220 (IXTP) Outline



Pins: 1 - Gate 2 - Drain 3 - Source

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .170     | .190 | 4.32        | 4.83  |
| b   | .025     | .040 | 0.64        | 1.02  |
| b1  | .045     | .065 | 1.15        | 1.65  |
| c   | .014     | .022 | 0.35        | 0.56  |
| D   | .580     | .630 | 14.73       | 16.00 |
| E   | .390     | .420 | 9.91        | 10.66 |
| e   | .100 BSC |      | 2.54 BSC    |       |
| F   | .045     | .055 | 1.14        | 1.40  |
| H1  | .230     | .270 | 5.85        | 6.85  |
| J1  | .090     | .110 | 2.29        | 2.79  |
| k   | 0        | .015 | 0           | 0.38  |
| L   | .500     | .550 | 12.70       | 13.97 |
| L1  | .110     | .230 | 2.79        | 5.84  |
| ØP  | .139     | .161 | 3.53        | 4.08  |
| Q   | .100     | .125 | 2.54        | 3.18  |

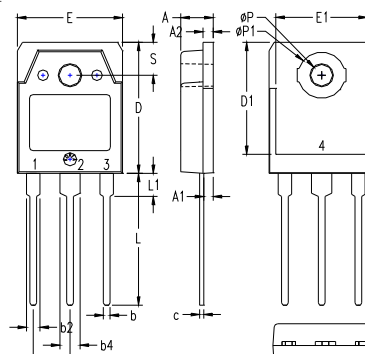
## TO-247 (IXTH) Outline



Terminals: 1 - Gate 2 - Drain  
3 - Source

| 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  |
| L <sub>1</sub> |            | 4.50  |        | .177  |
| ØP             | 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   |

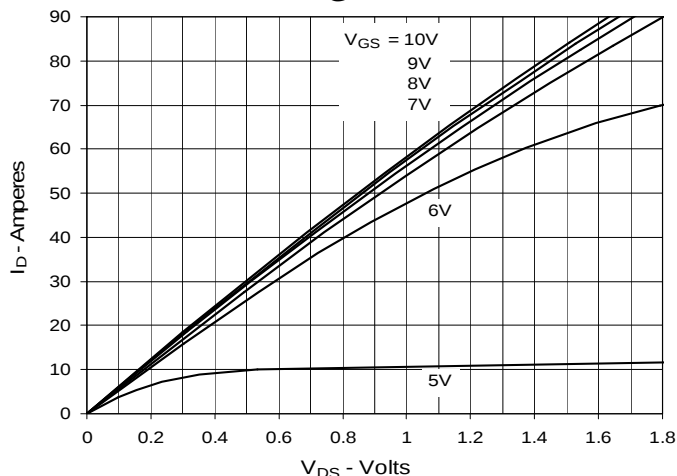
## TO-3P (IXTQ) Outline



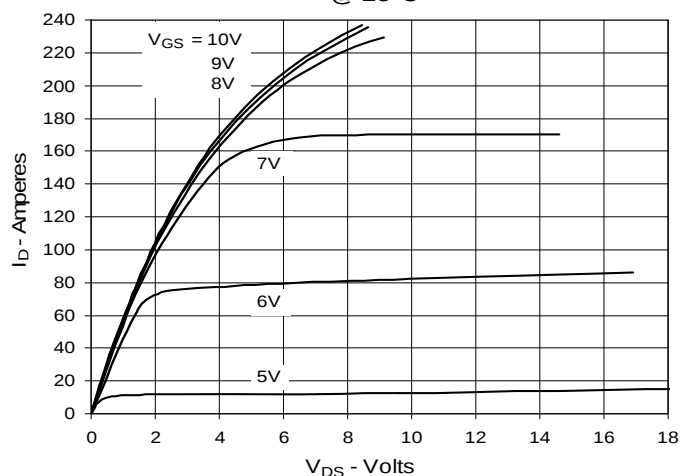
1 - GATE  
2 - DRAIN (COLLECTOR)  
3 - SOURCE (EMITTER)  
4 - DRAIN (COLLECTOR)

| 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     | .799 | 19.80       | 20.30 |
| 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  |
| ØP  | .126     | .134 | 3.20        | 3.40  |
| ØP1 | .272     | .280 | 6.90        | 7.10  |
| S   | .193     | .201 | 4.90        | 5.10  |

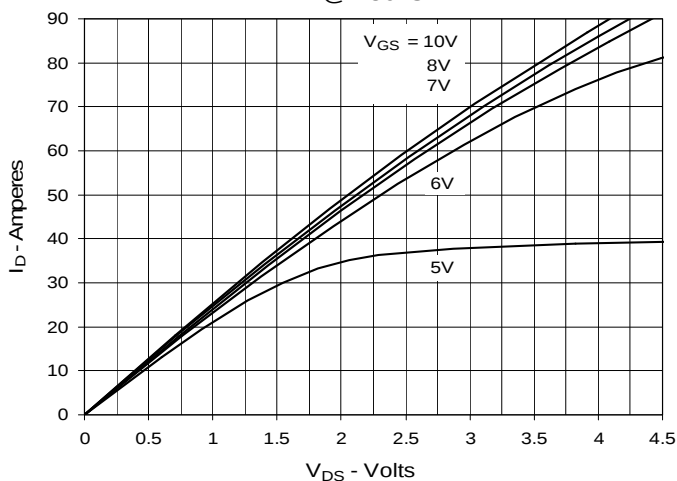
**Fig. 1. Output Characteristics**  
@ 25°C



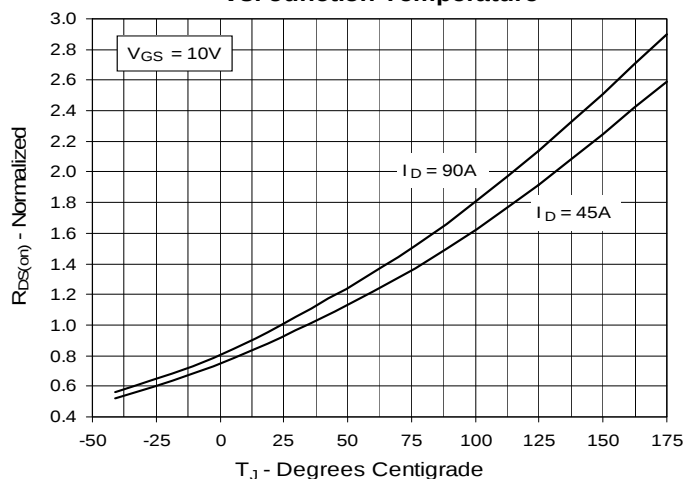
**Fig. 2. Extended Output Characteristics**  
@ 25°C



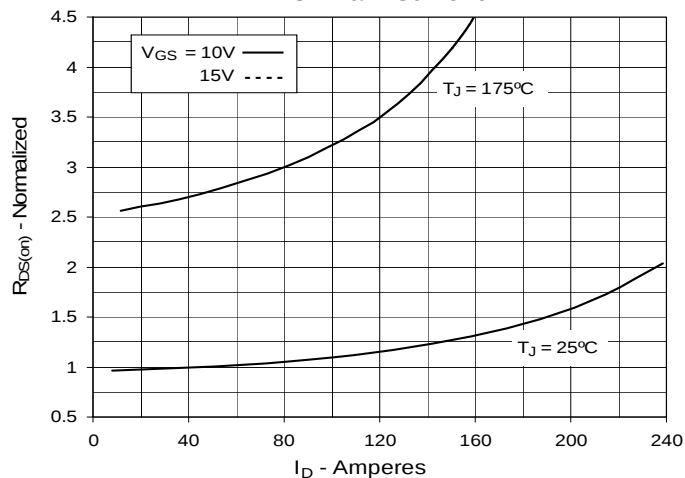
**Fig. 3. Output Characteristics**  
@ 150°C



**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 45A$  Value**  
vs. Junction Temperature



**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 45A$  Value**  
vs. Drain Current



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

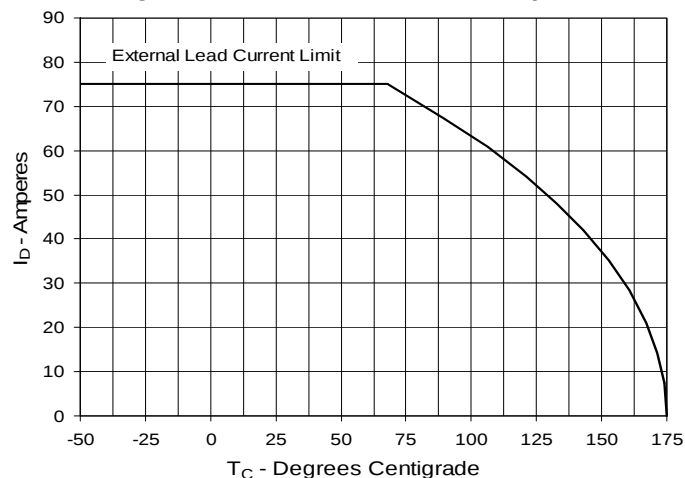


Fig. 7. Input Admittance

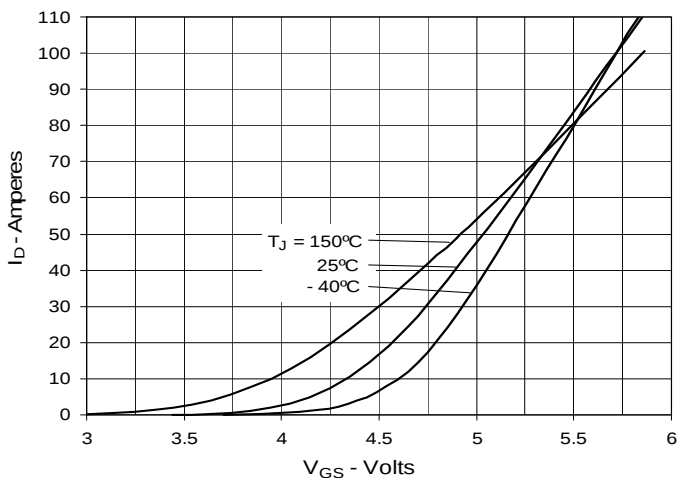


Fig. 8. Transconductance

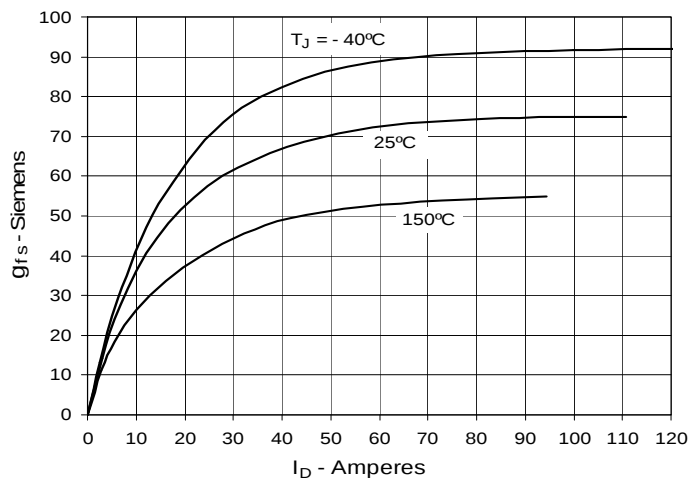


Fig. 9. Forward Voltage Drop of Intrinsic Diode

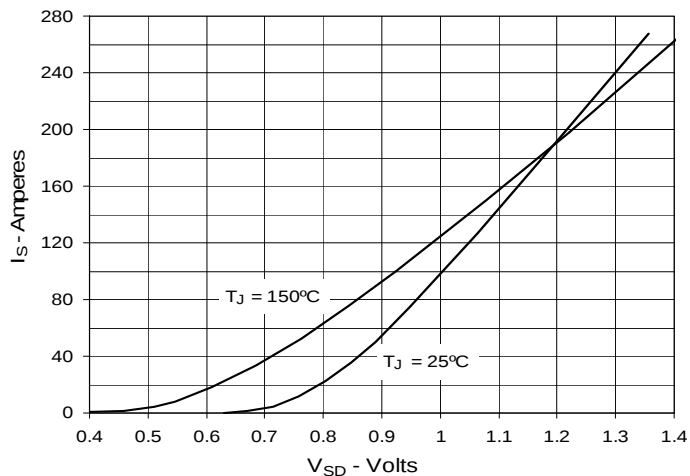


Fig. 10. Gate Charge

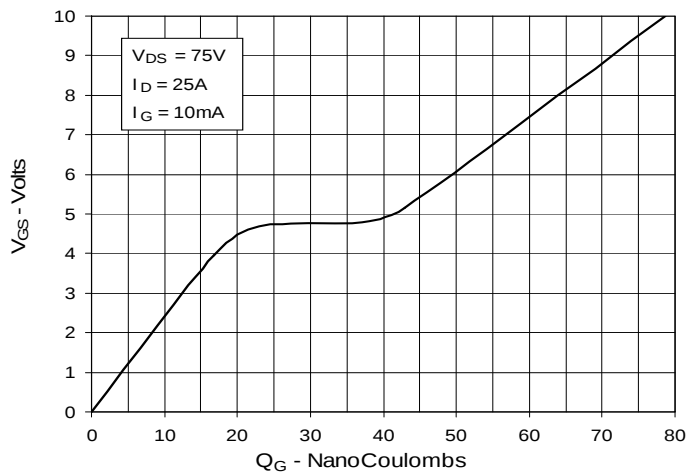


Fig. 11. Capacitance

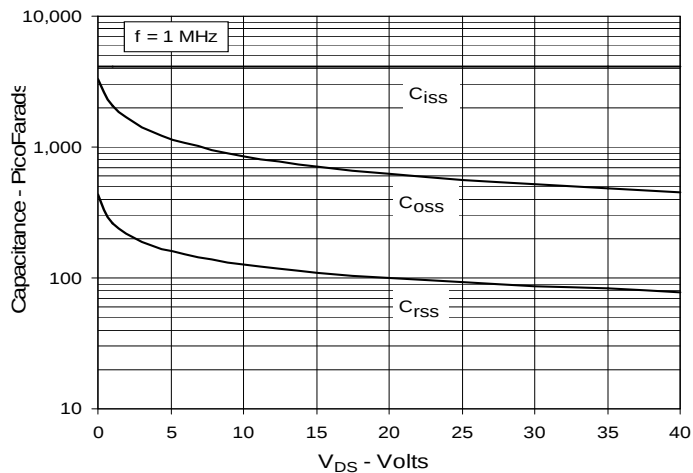
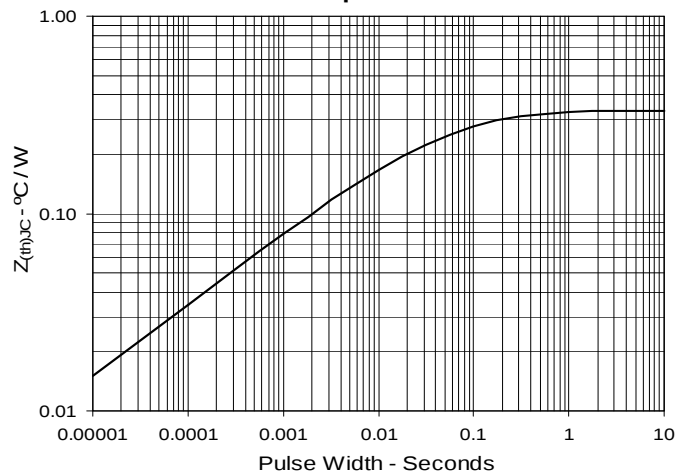
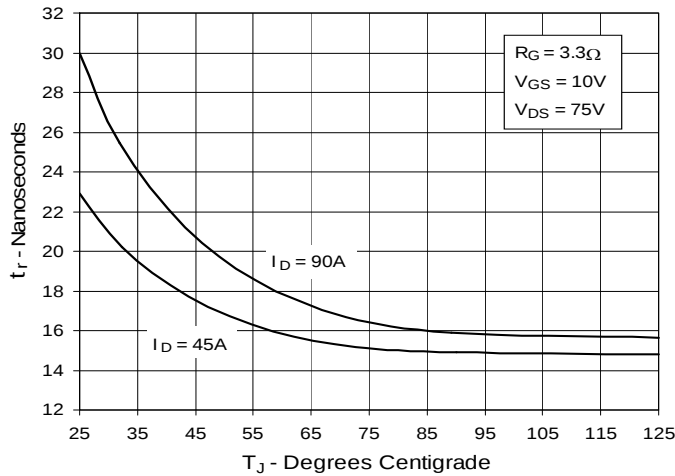


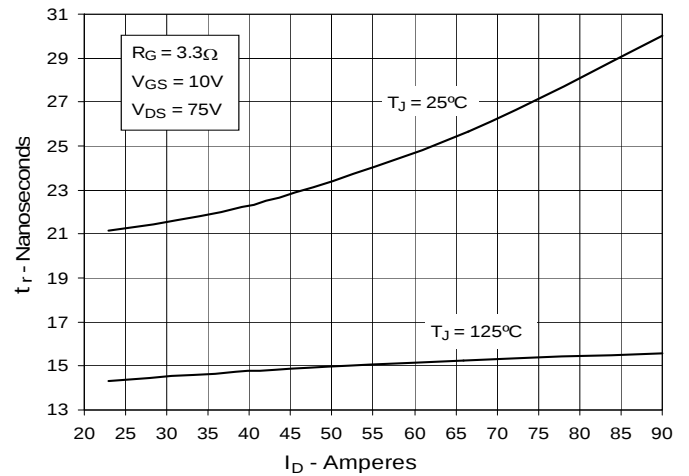
Fig. 12. Maximum Transient Thermal Impedance



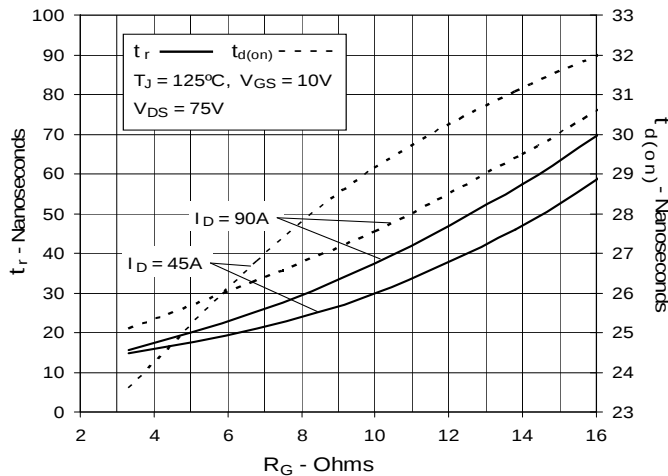
**Fig. 13. Resistive Turn-on  
Rise Time vs. Junction Temperature**



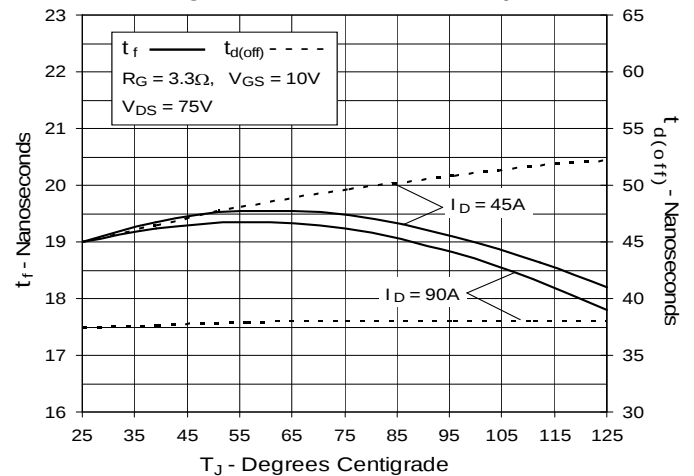
**Fig. 14. Resistive Turn-on  
Rise Time vs. Drain Current**



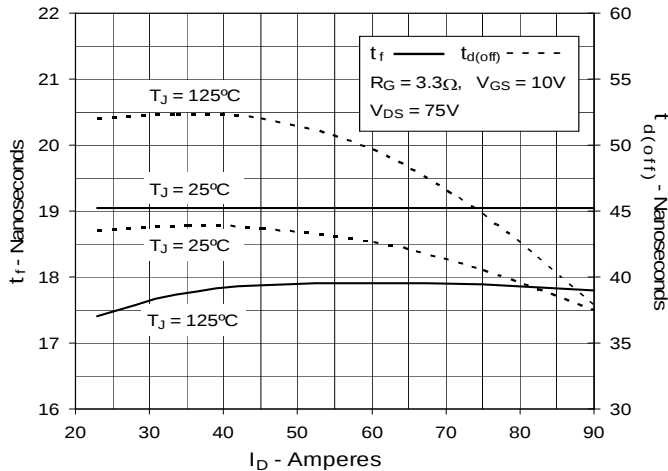
**Fig. 15. Resistive Turn-on  
Switching Times vs. Gate Resistance**



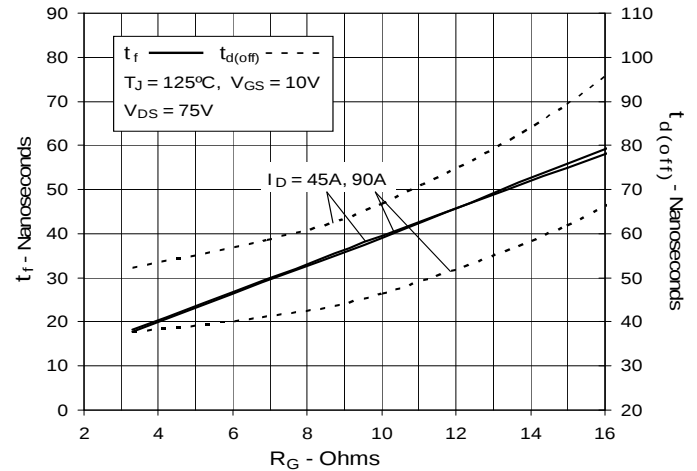
**Fig. 16. Resistive Turn-off  
Switching Times vs. Junction Temperature**



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



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





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