

## Trench™ Power MOSFET

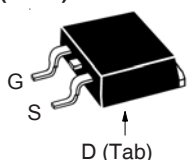
N-Channel Enhancement Mode

**IXTA76N25T**  
**IXTP76N25T**  
**IXTQ76N25T**  
**IXTH76N25T**

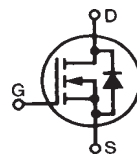
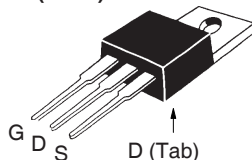
**$V_{DSS} = 250V$**   
 **$I_{D25} = 76A$**   
 **$R_{DS(on)} \leq 44m\Omega$**

Typical Avalanched BV = 300V

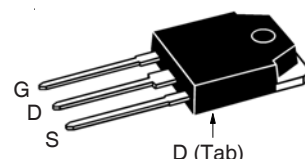
TO-263 AA (IXTA)



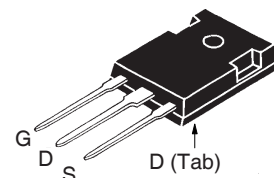
TO-220AB (IXTP)



TO-3P (IXTQ)



TO-247(IXTH)



G = Gate      D = Drain  
S = Source    Tab = Drain

| Symbol     | Test Conditions                                             | Maximum Ratings    |             |
|------------|-------------------------------------------------------------|--------------------|-------------|
| $V_{DSS}$  | $T_J = 25^{\circ}C$ to $150^{\circ}C$                       | 250                | V           |
| $V_{DGR}$  | $T_J = 25^{\circ}C$ to $150^{\circ}C$ , $R_{GS} = 1M\Omega$ | 250                | V           |
| $V_{GSS}$  | Continuous                                                  | $\pm 20$           | V           |
| $V_{GSM}$  | Transient                                                   | $\pm 30$           | V           |
| $I_{D25}$  | $T_C = 25^{\circ}C$                                         | 76                 | A           |
| $I_{DM}$   | $T_C = 25^{\circ}C$ , Pulse Width Limited by $T_{JM}$       | 170                | A           |
| $I_A$      | $T_C = 25^{\circ}C$                                         | 8                  | A           |
| $E_{AS}$   | $T_C = 25^{\circ}C$                                         | 1.5                | J           |
| $P_D$      | $T_C = 25^{\circ}C$                                         | 460                | W           |
| $T_J$      |                                                             | -55 ... +150       | $^{\circ}C$ |
| $T_{JM}$   |                                                             | 150                | $^{\circ}C$ |
| $T_{stg}$  |                                                             | -55 ... +150       | $^{\circ}C$ |
| $T_L$      | Maximum Lead Temperature for Soldering                      | 300                | $^{\circ}C$ |
| $T_{SOLD}$ | Plastic Body for 10s                                        | 260                | $^{\circ}C$ |
| $F_C$      | Mounting Force (TO-263)                                     | 10..65 / 2.2..14.6 | N/lb        |
| $M_d$      | Mounting Torque (TO-220, TO-3P & TO-247)                    | 1.13/10            | Nm/lb.in    |
| Weight     | TO-263                                                      | 2.5                | g           |
|            | TO-220                                                      | 3.0                | g           |
|            | TO-3P                                                       | 5.5                | g           |
|            | TO-247                                                      | 6.0                | g           |

| Symbol       | Test Conditions<br>( $T_J = 25^{\circ}C$ , Unless Otherwise Specified) | Characteristic Values |      |               |
|--------------|------------------------------------------------------------------------|-----------------------|------|---------------|
|              |                                                                        | Min.                  | Typ. | Max.          |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 1mA$                                            | 250                   |      | V             |
|              | $V_{GS} = 0V$ , $I_D = 10mA$                                           |                       | 300  | V             |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250\mu A$                                   | 3.0                   |      | 5.0 V         |
| $I_{GSS}$    | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$                                     |                       |      | $\pm 100$ nA  |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$                                     |                       |      | 2 $\mu A$     |
|              | $T_J = 125^{\circ}C$                                                   |                       |      | 200 $\mu A$   |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                    |                       |      | 44 m $\Omega$ |

### Features

- Avalanche Rated
- High Current Handling Capability
- Fast Intrinsic Rectifier
- Low  $R_{DS(on)}$

### Advantages

- Easy to Mount
- Space Savings
- High Power Density

### Applications

- DC-DC Converters
- Battery Chargers
- Switch-Mode and Resonant-Mode Power Supplies
- DC Choppers
- AC Motor Drives
- Uninterruptible Power Supplies
- High Speed Power Switching Applications

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)                                                               | Characteristic Values |      |                    |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|--------------------|
|              |                                                                                                                                         | Min.                  | Typ. | Max.               |
| $g_{fs}$     | $V_{DS} = 10V, I_D = 0.5 \cdot I_{D25}$ , Note 1                                                                                        | 43                    | 72   | S                  |
| $C_{iss}$    | $V_{GS} = 0V, V_{DS} = 25V, f = 1\text{MHz}$                                                                                            |                       | 4920 | pF                 |
| $C_{oss}$    |                                                                                                                                         |                       | 470  | pF                 |
| $C_{rss}$    |                                                                                                                                         |                       | 70   | pF                 |
| $t_{d(on)}$  | <b>Resistive Switching Times</b><br>$V_{GS} = 15V, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$<br>$R_G = 3.3\Omega$ (External) |                       | 22   | ns                 |
| $t_r$        |                                                                                                                                         |                       | 25   | ns                 |
| $t_{d(off)}$ |                                                                                                                                         |                       | 56   | ns                 |
| $t_f$        |                                                                                                                                         |                       | 29   | ns                 |
| $Q_{g(on)}$  | $V_{GS} = 10V, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 25A$                                                                                   |                       | 92   | nC                 |
| $Q_{gs}$     |                                                                                                                                         |                       | 28   | nC                 |
| $Q_{gd}$     |                                                                                                                                         |                       | 21   | nC                 |
| $R_{thJC}$   | TO-220<br>TO-3P & TO-247                                                                                                                |                       | 0.27 | $^\circ\text{C/W}$ |
| $R_{thCH}$   |                                                                                                                                         |                       | 0.50 | $^\circ\text{C/W}$ |
|              |                                                                                                                                         |                       | 0.25 | $^\circ\text{C/W}$ |

#### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) | Characteristic Values |      |         |
|----------|---------------------------------------------------------------------------|-----------------------|------|---------|
|          |                                                                           | Min.                  | Typ. | Max.    |
| $I_S$    | $V_{GS} = 0V$                                                             |                       |      | 76 A    |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                               |                       |      | 200 A   |
| $V_{SD}$ | $I_F = I_S, V_{GS} = 0V$ , Note 1                                         |                       |      | 1.5 V   |
| $t_{rr}$ | $I_F = 38A, -di/dt = 250A/\mu s$<br>$V_R = 100V, V_{GS} = 0V$             |                       | 148  | ns      |
| $I_{RM}$ |                                                                           |                       | 21   | A       |
| $Q_{RM}$ |                                                                           |                       | 1.6  | $\mu C$ |

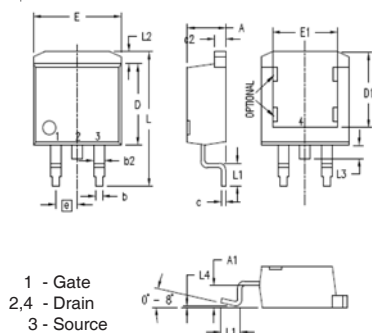
Note 1: Pulse test,  $t \leq 300\mu s$ , duty cycle,  $d \leq 2\%$ .

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:

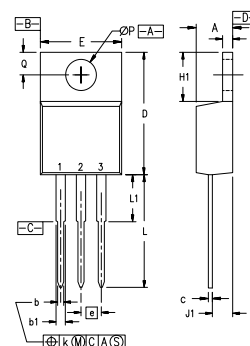
|           |           |           |           |              |              |              |              |              |             |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 4,835,592 | 4,931,844 | 5,049,961 | 5,237,481 | 6,162,665    | 6,404,065 B1 | 6,683,344    | 6,727,585    | 7,005,734 B2 | 7,157,338B2 |
| 4,860,072 | 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 Outline



| 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  |

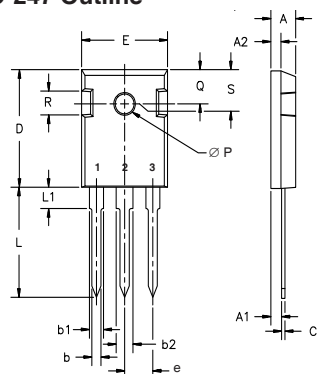
## TO-220 Outline



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  |
| DP  | .139     | .161 | 3.53        | 4.08  |
| Q   | .100     | .125 | 2.54        | 3.18  |

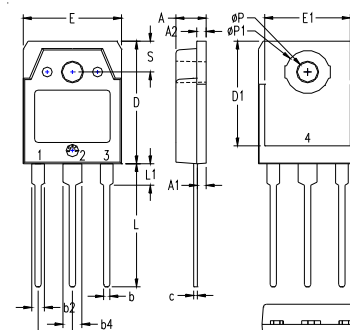
## TO-247 Outline



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  |
| L1             |            | 4.50  |         | .177  |
| DP             | 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 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  |
| DP  | .126     | .134 | 3.20        | 3.40  |
| DP1 | .272     | .280 | 6.90        | 7.10  |
| S   | .193     | .201 | 4.90        | 5.10  |

Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$

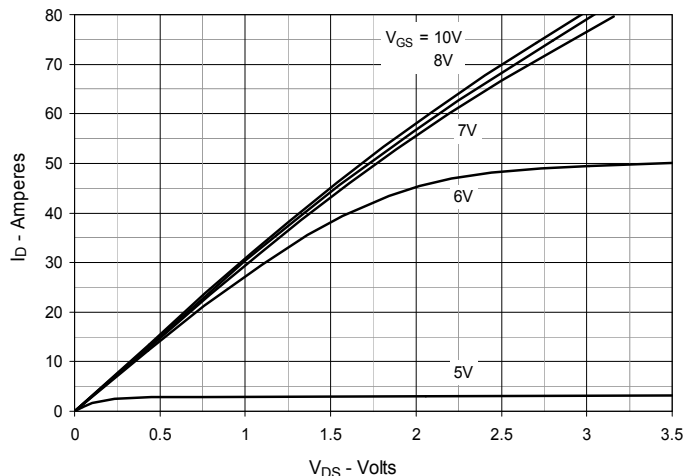


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

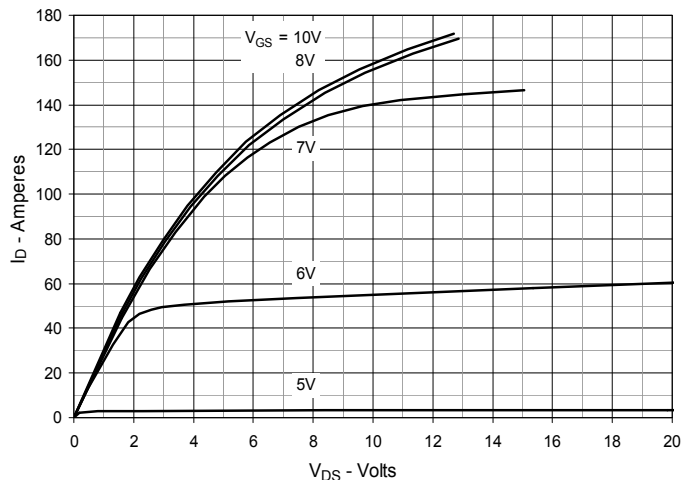


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

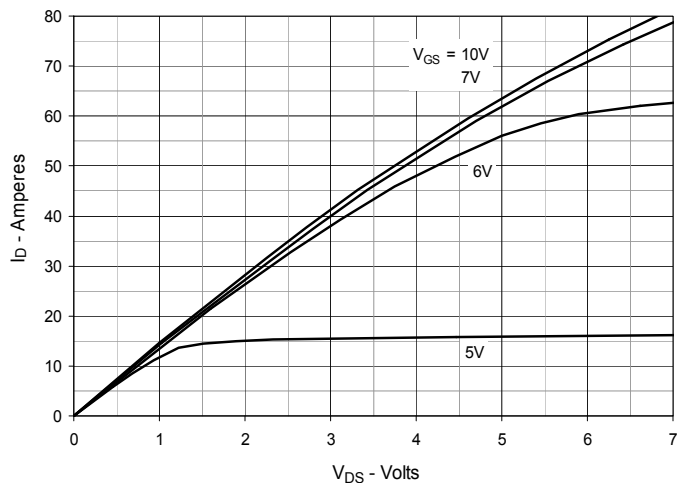


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 38\text{A}$  Value vs. Junction Temperature

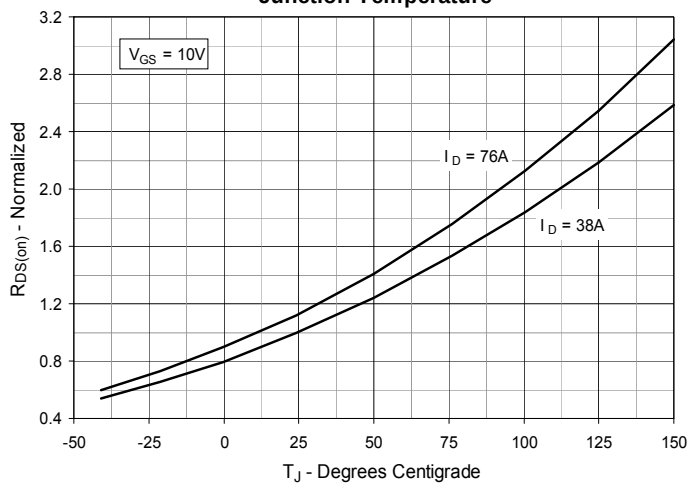


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 38\text{A}$  Value vs. Drain Current

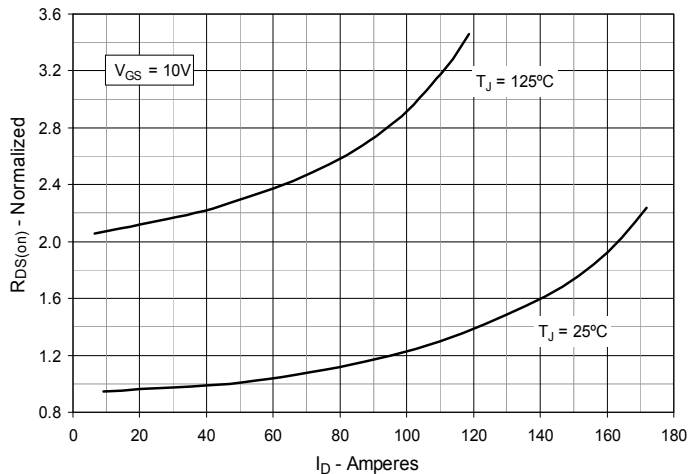


Fig. 6. Drain Current vs. Case Temperature

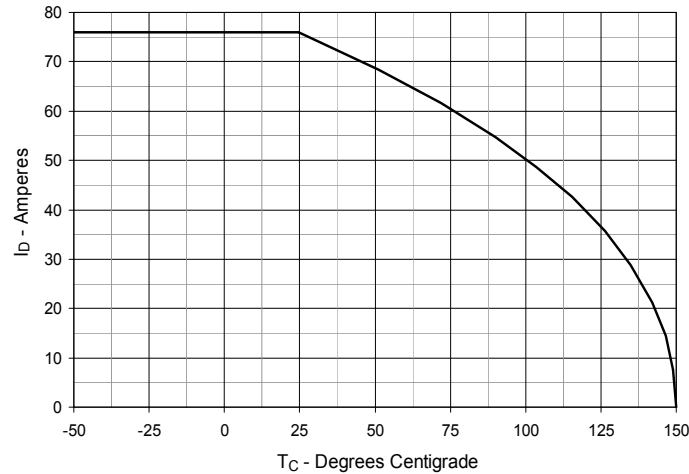


Fig. 7. Input Admittance

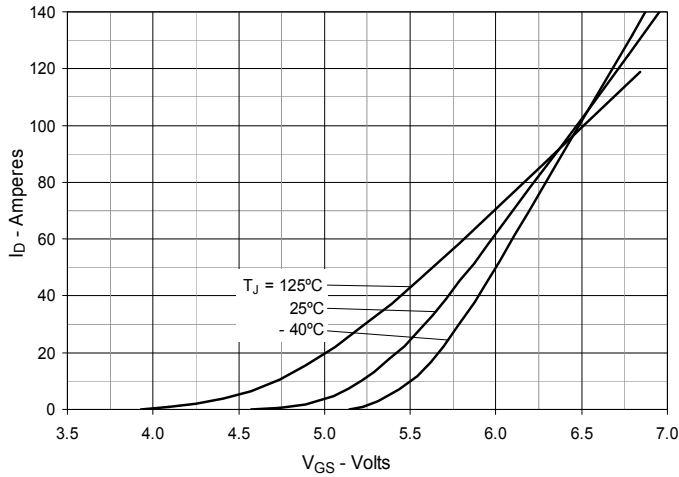


Fig. 8. Transconductance

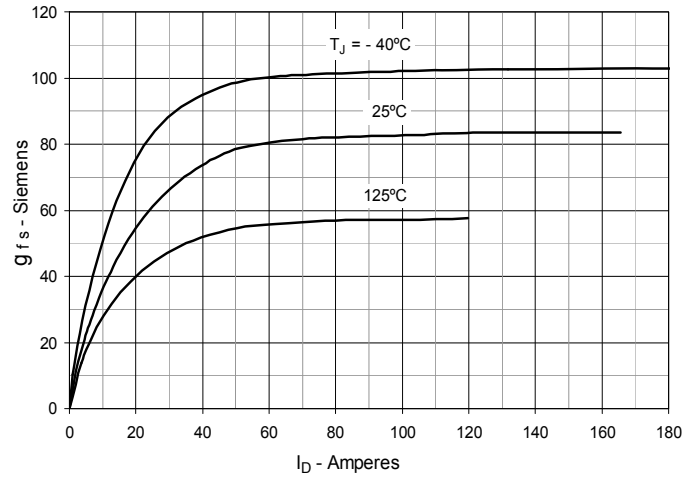


Fig. 9. Forward Voltage Drop of Intrinsic Diode

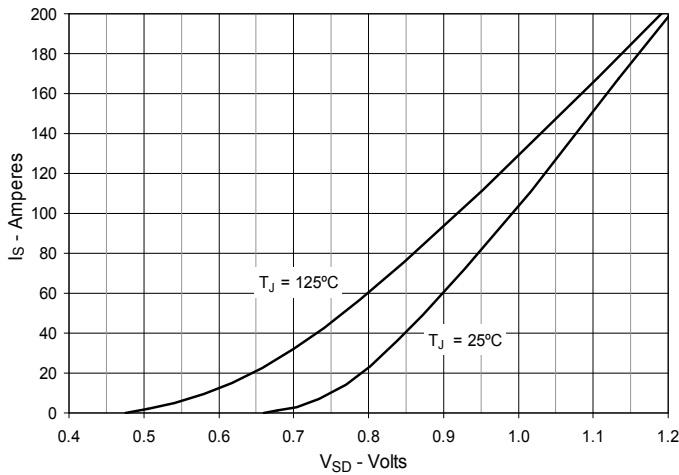


Fig. 10. Gate Charge

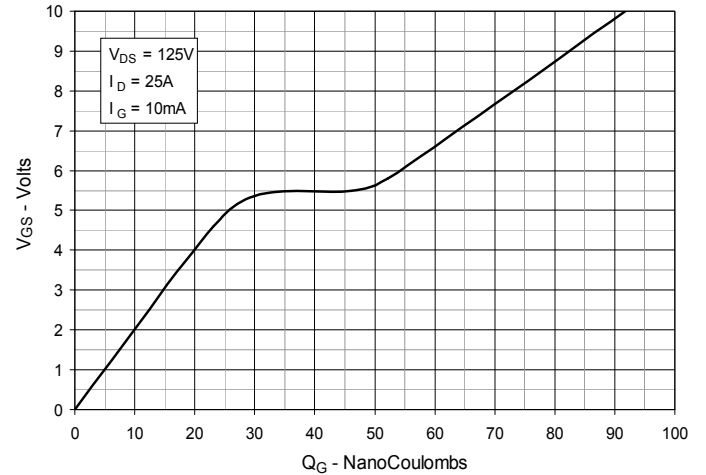


Fig. 11. Capacitance

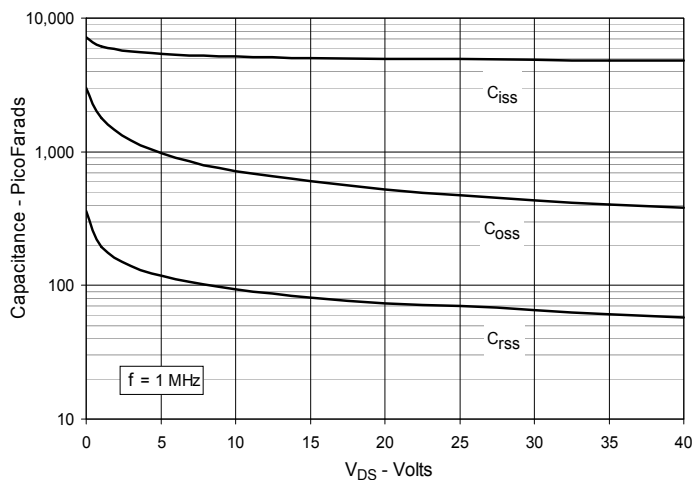
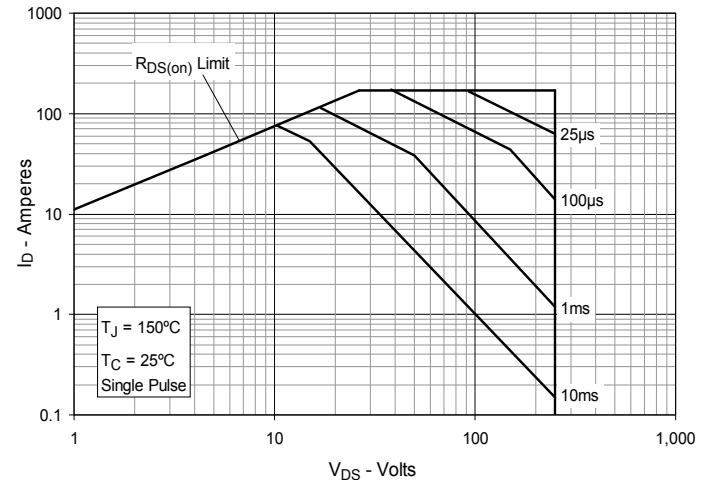
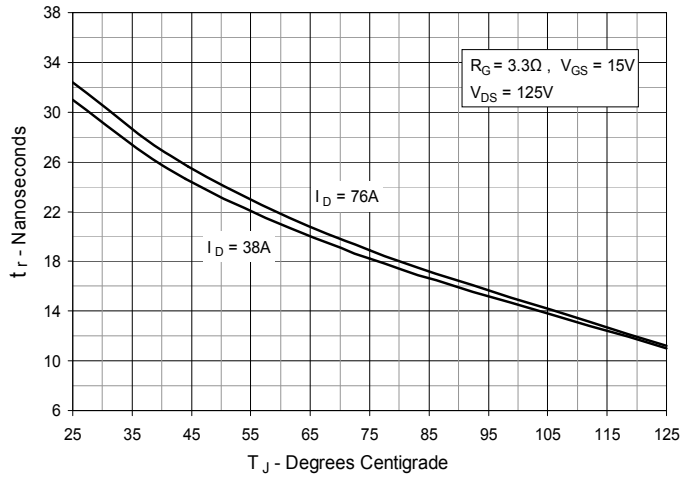


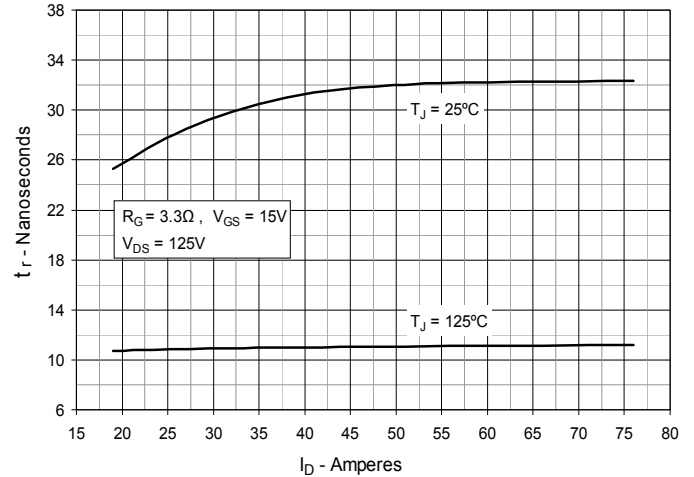
Fig. 12. Forward-Bias Safe Operating Area



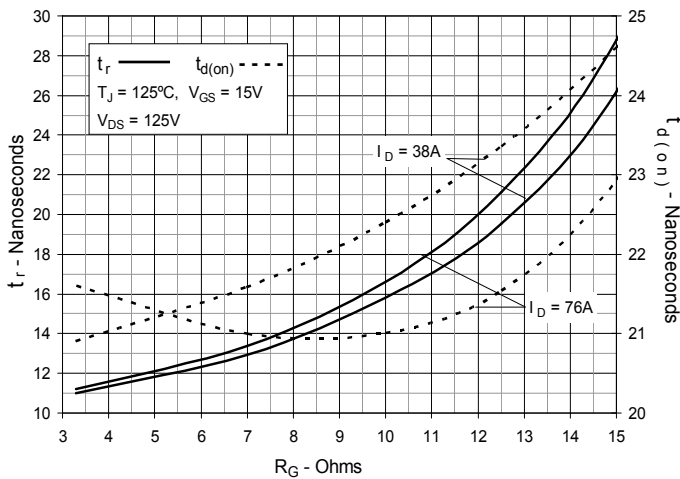
**Fig. 13. Resistive Turn-on Rise Time vs. Junction Temperature**



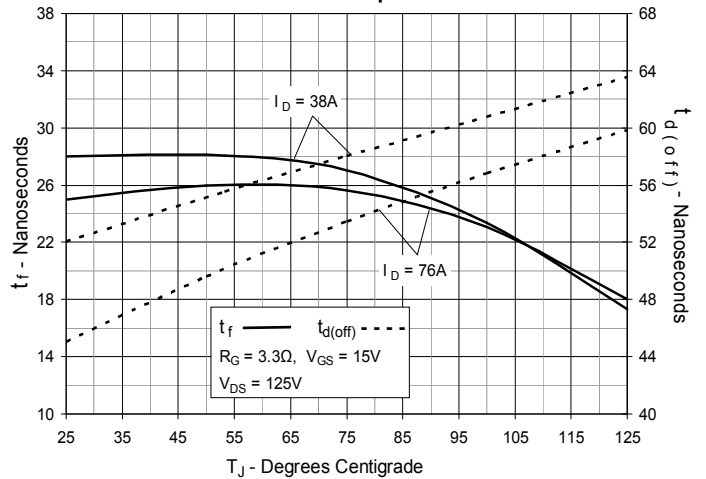
**Fig. 14. Resistive Turn-on Rise Time vs. Drain Current**



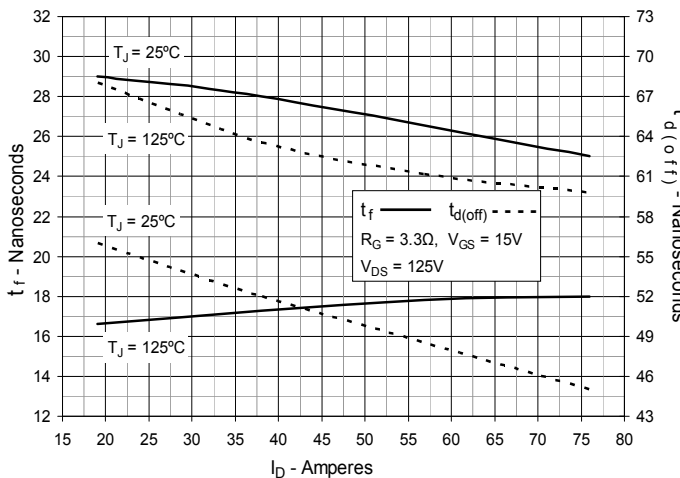
**Fig. 15. Resistive Turn-on Switching Times vs. Gate Resistance**



**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**

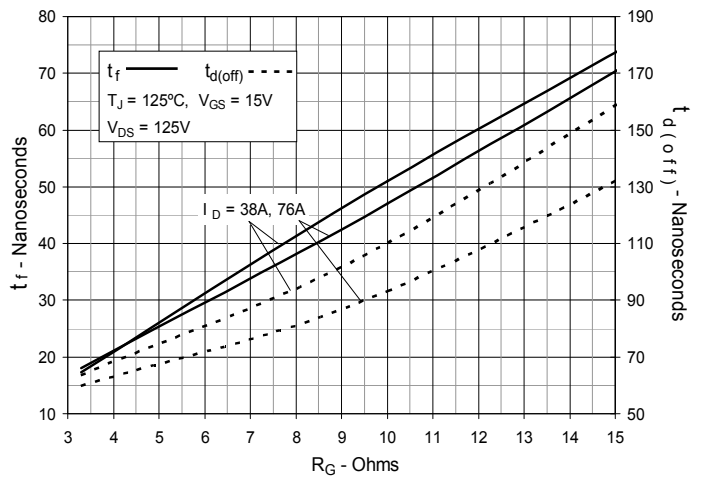
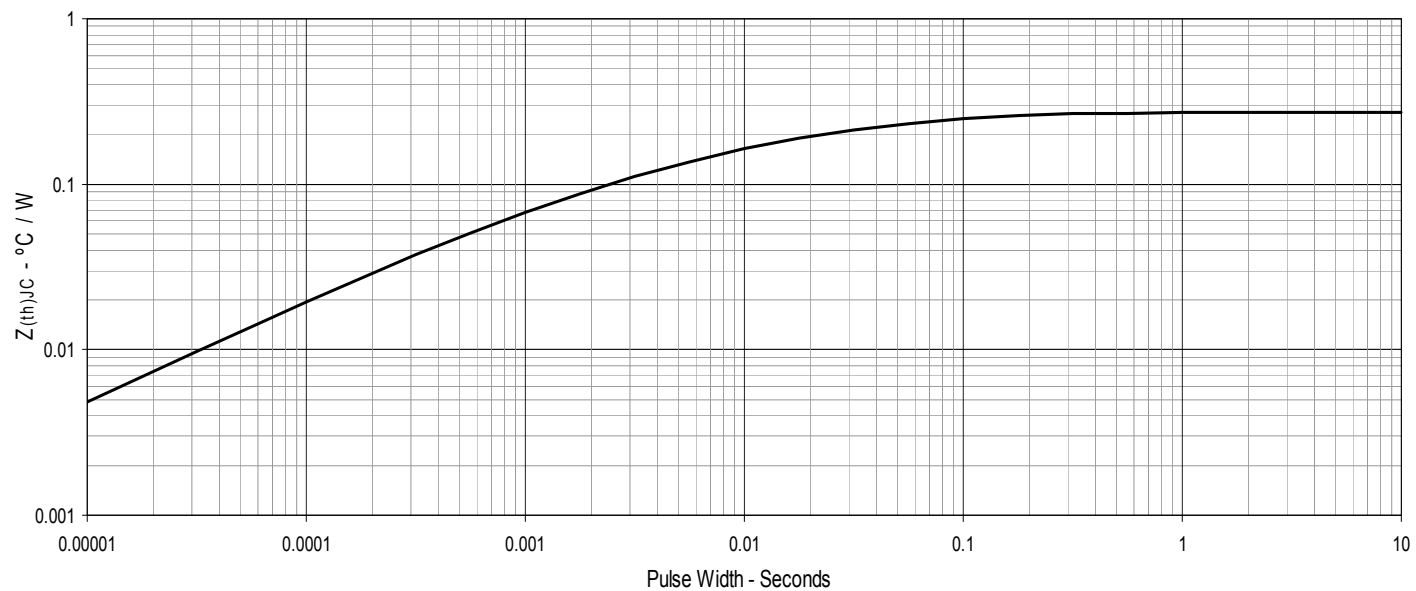


Fig. 19. Maximum Transient Thermal Impedance





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