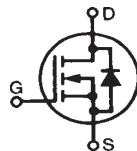


## Trench Gate Power MOSFET

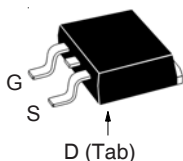
IXTA50N25T IXTQ50N25T  
IXTP50N25T IXTH50N25T

N-Channel Enhancement Mode

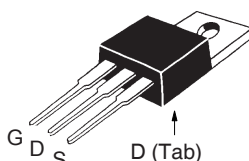
$$\begin{aligned} V_{DSS} &= 250V \\ I_{D25} &= 50A \\ R_{DS(on)} &\leq 60m\Omega \end{aligned}$$



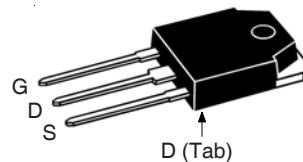
TO-263 AA (IXTA)



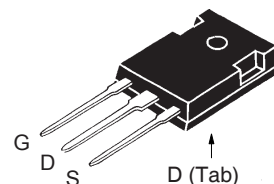
TO-220AB (IXTP)



TO-3P (IXTQ)



TO-247 (IXTH)



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

| Symbol    | Test Conditions                                                       | Maximum Ratings    |                  |
|-----------|-----------------------------------------------------------------------|--------------------|------------------|
| $V_{DSS}$ | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                       | 250                | V                |
| $V_{DGR}$ | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GS} = 1M\Omega$ | 250                | V                |
| $V_{GSM}$ | Transient                                                             | $\pm 30$           | V                |
| $I_{D25}$ | $T_C = 25^\circ\text{C}$                                              | 50                 | A                |
| $I_{DM}$  | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$            | 130                | A                |
| $I_A$     | $T_C = 25^\circ\text{C}$                                              | 5                  | A                |
| $E_{AS}$  | $T_C = 25^\circ\text{C}$                                              | 1.5                | J                |
| $P_D$     | $T_C = 25^\circ\text{C}$                                              | 400                | W                |
| $T_J$     |                                                                       | -55 ... +150       | $^\circ\text{C}$ |
| $T_{JM}$  |                                                                       | 150                | $^\circ\text{C}$ |
| $T_{stg}$ |                                                                       | -55 ... +150       | $^\circ\text{C}$ |
| $T_L$     | 1.6mm (0.062in.) from Case for 10s                                    | 300                | $^\circ\text{C}$ |
|           | Plastic Body for 10 s                                                 | 260                | $^\circ\text{C}$ |
| $M_d$     | Mounting Torque (TO-220, TO-3P & TO-247)                              | 1.13 / 10          | Nmlb.in.         |
| $F_C$     | Mounting Force (TO-263)                                               | 10..65 / 2.2..14.6 | N/lb.            |
| 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>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) | Characteristic Values |      |                   |
|--------------|---------------------------------------------------------------------------|-----------------------|------|-------------------|
|              |                                                                           | Min.                  | Typ. | Max.              |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 1mA$                                               | 250                   |      | V                 |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 1mA$                                           | 3.0                   |      | 5.0 V             |
| $I_{GSS}$    | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$                                        |                       |      | $\pm 100$ nA      |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 125^\circ\text{C}$           |                       |      | 1 $\mu\text{A}$   |
|              |                                                                           |                       |      | 150 $\mu\text{A}$ |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                       |                       |      | 60 m $\Omega$     |

### Features

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

### Advantages

- High Power Density
- Easy to Mount
- Space Savings

### Applications

- DC-DC Converters
- Battery Chargers
- Switch-Mode and Resonant-Mode Power Supplies
- DC Choppers
- AC and DC Motor Drives
- Uninterrupted 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.                                     |
| $g_{fs}$     | $V_{DS} = 10\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                                                                                           | 35                    | 58           | S                                        |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                     |                       | 4000         | pF                                       |
| $C_{oss}$    |                                                                                                                                                      |                       | 410          | pF                                       |
| $C_{rss}$    |                                                                                                                                                      |                       | 60           | 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) |                       | 14           | ns                                       |
| $t_r$        |                                                                                                                                                      |                       | 25           | ns                                       |
| $t_{d(off)}$ |                                                                                                                                                      |                       | 47           | ns                                       |
| $t_f$        |                                                                                                                                                      |                       | 25           | ns                                       |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                                                     |                       | 78           | nC                                       |
| $Q_{gs}$     |                                                                                                                                                      |                       | 19           | nC                                       |
| $Q_{gd}$     |                                                                                                                                                      |                       | 22           | nC                                       |
| $R_{thJC}$   | (TO-220)<br>(TO-3P & TO-247)                                                                                                                         |                       | 0.31         | $^\circ\text{C/W}$                       |
| $R_{thCH}$   |                                                                                                                                                      |                       | 0.50<br>0.25 | $^\circ\text{C/W}$<br>$^\circ\text{C/W}$ |

#### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)                             | Characteristic Values |       |               |
|----------|-------------------------------------------------------------------------------------------------------|-----------------------|-------|---------------|
|          |                                                                                                       | Min.                  | Typ . | Max.          |
| $I_S$    | $V_{GS} = 0\text{V}$                                                                                  |                       |       | 50 A          |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                                           |                       |       | 200 A         |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                                           |                       |       | 1.5 V         |
| $t_{rr}$ | $I_F = 25\text{A}$ , $-di/dt = 250\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ , $V_{GS} = 0\text{V}$ |                       | 166   | ns            |
| $I_{RM}$ |                                                                                                       |                       | 23    | A             |
| $Q_{RM}$ |                                                                                                       |                       | 1.9   | $\mu\text{C}$ |

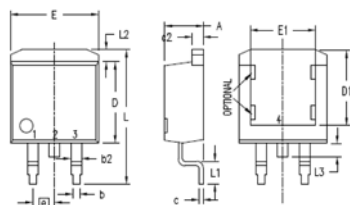
Note: 1. Pulse test,  $t \leq 300\mu\text{s}$ ; duty cycle,  $d \leq 2\%$ .

IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

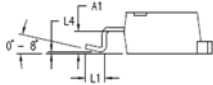
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |              |              |              |              |              |              |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|--------------|
| 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 | 7,157,338 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    |              |

## TO-263 (IXTA) Outline

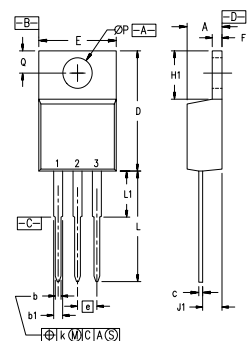


Terminals: 1 - Gate  
2 - Drain  
3 - Source



| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .360     | .390 | 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  |

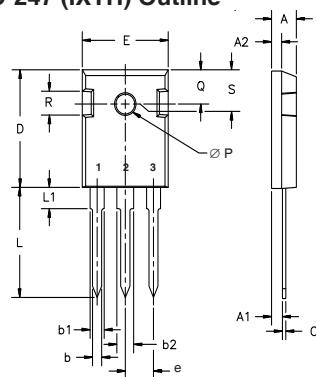
## TO-220 (IXTP) Outline



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  |

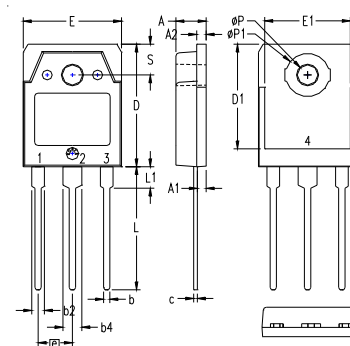
## TO-247 (IXTH) Outline



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  |
| L1             |            | 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



Terminals: 1 - Gate 2 - Drain  
3 - Source

| 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 @  $T_J = 25^\circ\text{C}$

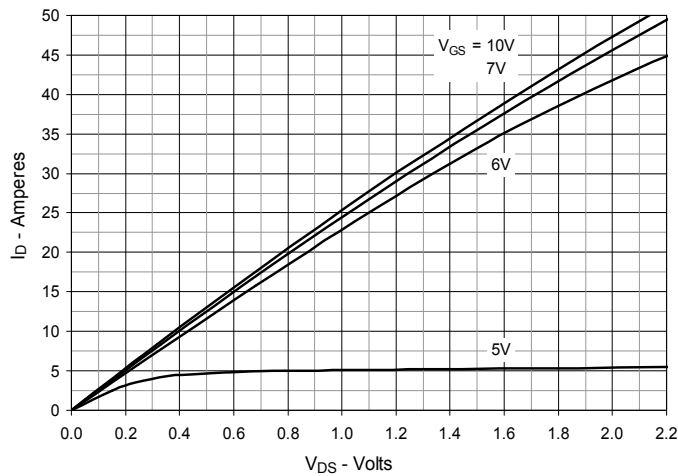


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

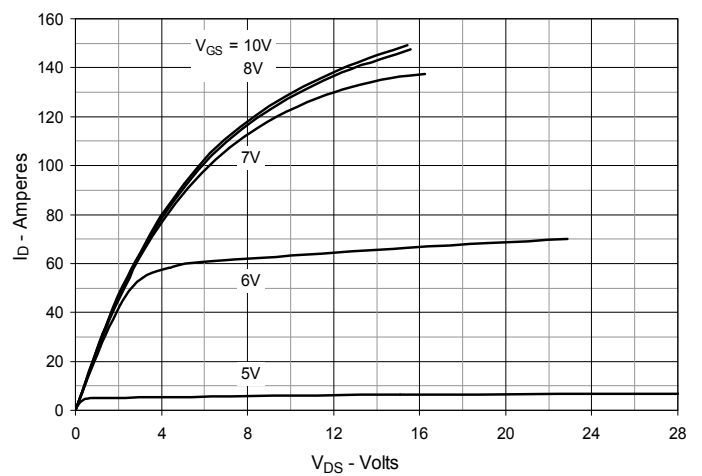


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

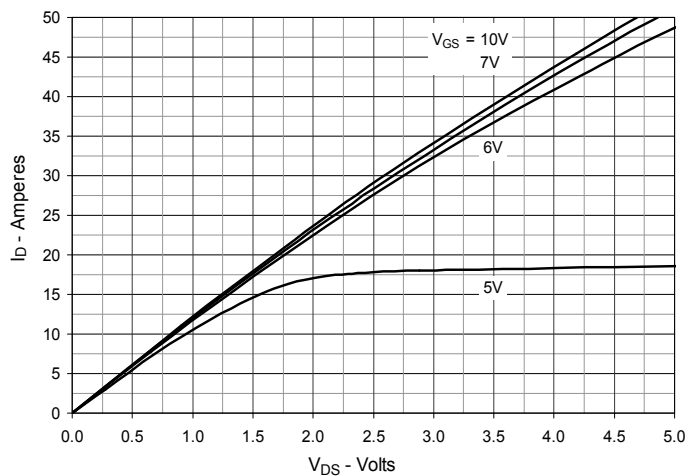


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 25\text{A}$  Value vs. Junction Temperature

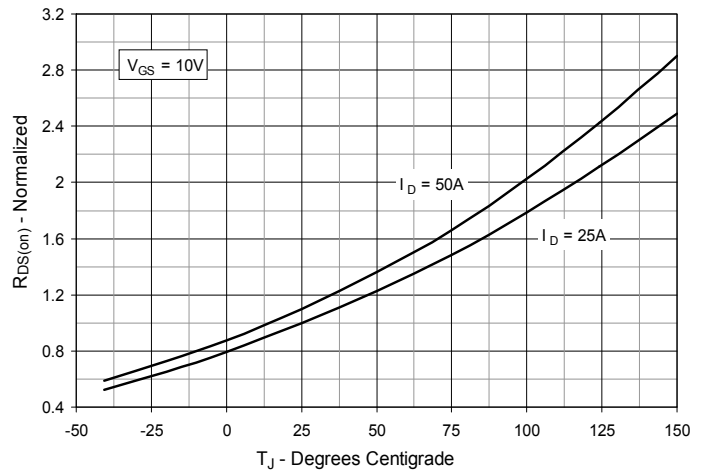


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 25\text{A}$  Value vs. Drain Current

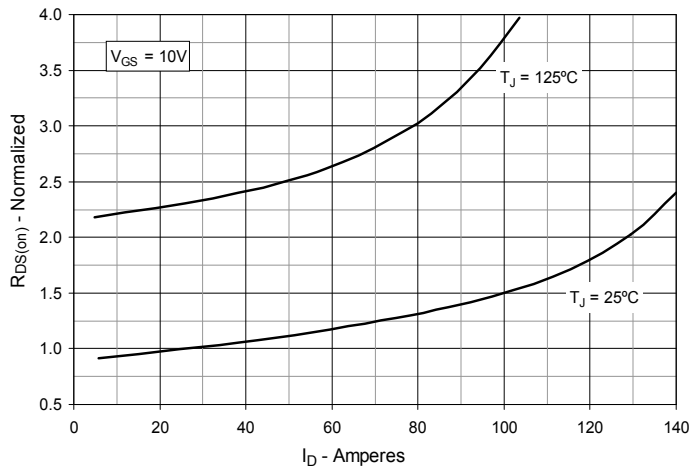


Fig. 6. Maximum Drain Current vs. Case Temperature

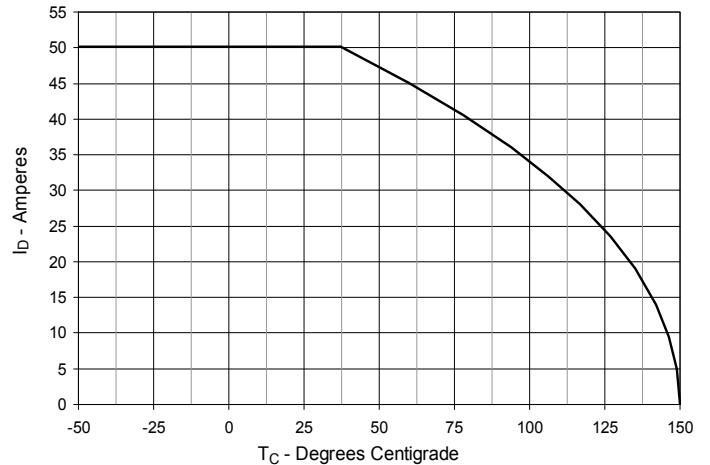


Fig. 7. Input Admittance

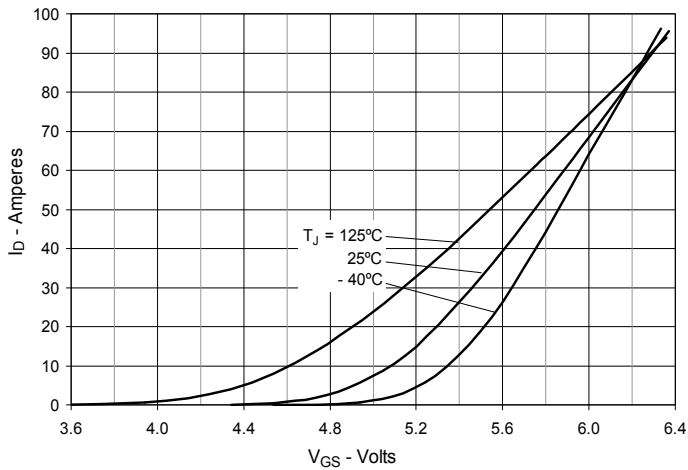


Fig. 8. Transconductance

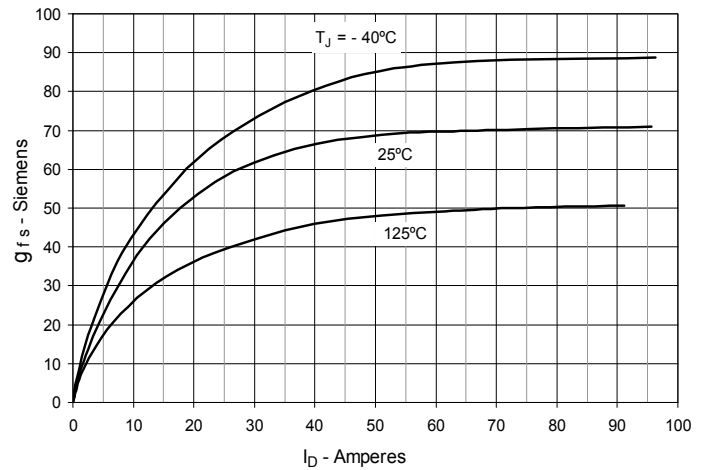


Fig. 9. Forward Voltage Drop of Intrinsic Diode

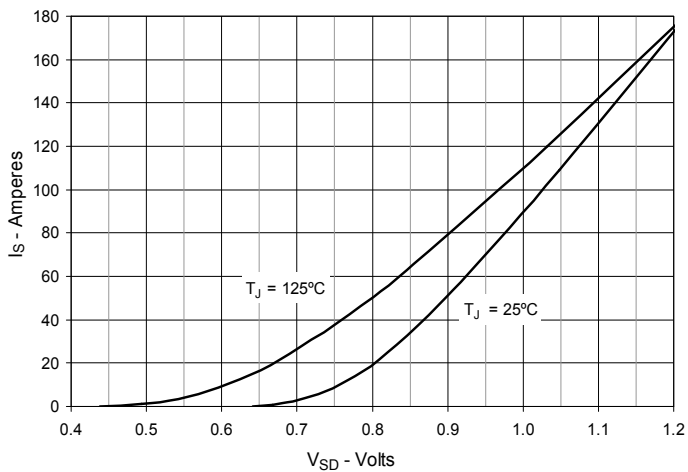


Fig. 10. Gate Charge

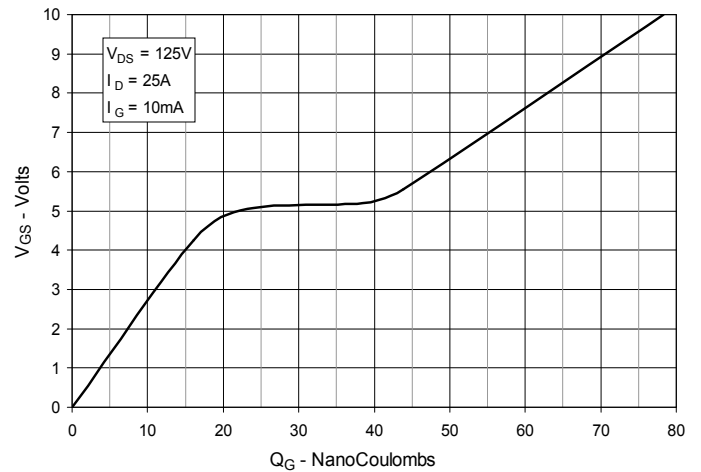


Fig. 11. Capacitance

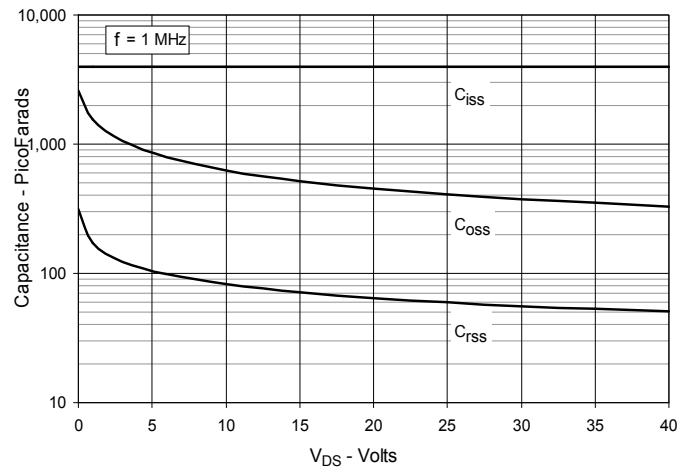
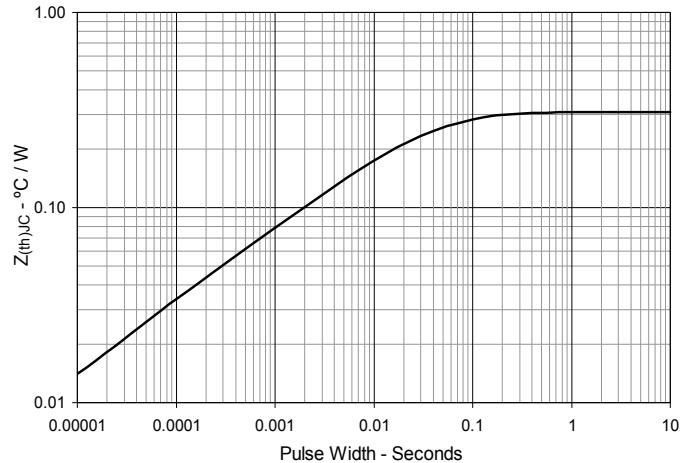
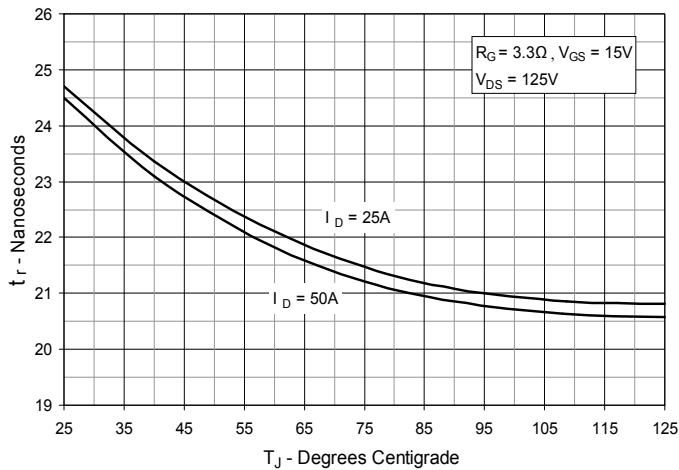


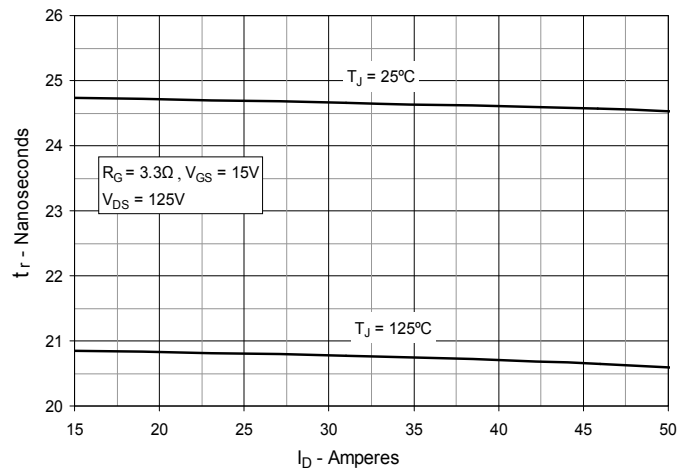
Fig. 12. Maximum Transient Thermal Impedance



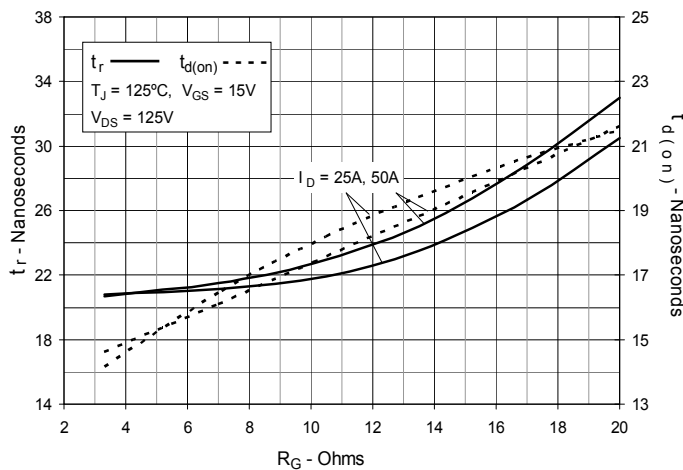
**Fig. 13. Resistive Turn-on  
Rise Time vs. Junction Temperature**



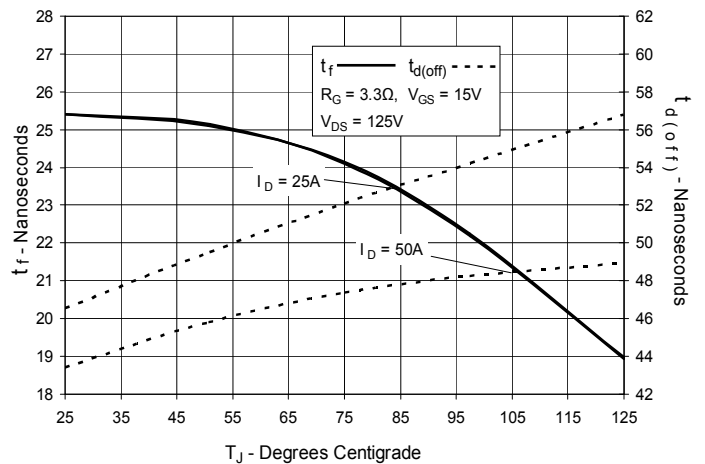
**Fig. 14. Resistive Turn-on  
Rise Time vs. Drain Current**



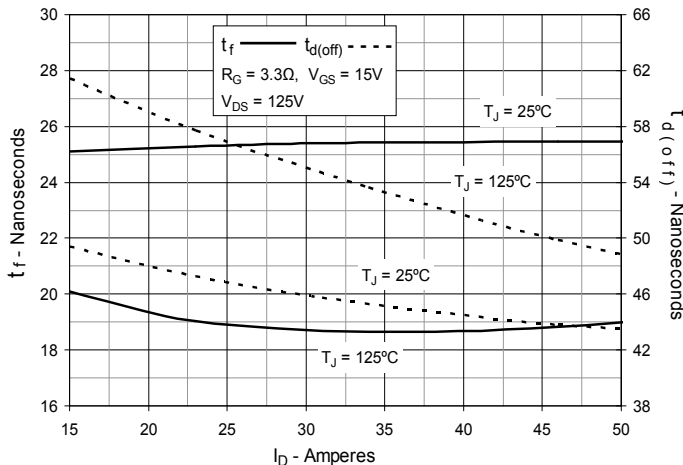
**Fig. 15. Resistive Turn-on  
Switching Times vs. Gate Resistance**



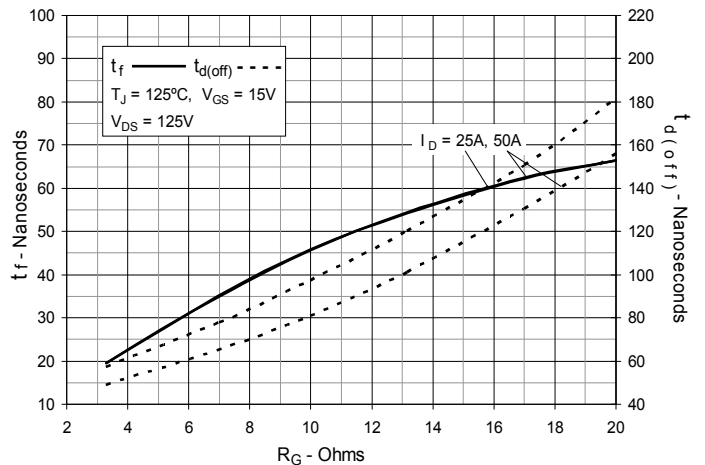
**Fig. 16. Resistive Turn-off  
Switching Times vs. Junction Temperature**



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



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





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