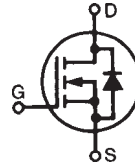


## TrenchT2™ Power MOSFET

## IXTA140N12T2 IXTP140N12T2

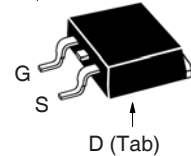
$$\begin{aligned} V_{DSS} &= 120V \\ I_{D25} &= 140A \\ R_{DS(on)} &\leq 10m\Omega \end{aligned}$$

N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Rectifier

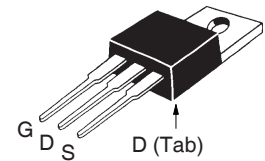


| Symbol     | Test Conditions                                                   | Maximum Ratings |                  |
|------------|-------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$  | $T_J = 25^\circ\text{C to } 175^\circ\text{C}$                    | 120             | V                |
| $V_{DGR}$  | $T_J = 25^\circ\text{C to } 175^\circ\text{C}, R_{GS} = 1M\Omega$ | 120             | V                |
| $V_{GSS}$  | Continuous                                                        | $\pm 20$        | V                |
| $V_{GSM}$  | Transient                                                         | $\pm 30$        | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$                                          | 140             | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$        | 350             | A                |
| $I_A$      | $T_C = 25^\circ\text{C}$                                          | 70              | A                |
| $E_{AS}$   | $T_C = 25^\circ\text{C}$                                          | 1.3             | J                |
| $P_D$      | $T_C = 25^\circ\text{C}$                                          | 577             | W                |
| $T_J$      |                                                                   | -55 ... +175    | $^\circ\text{C}$ |
| $T_{JM}$   |                                                                   | 175             | $^\circ\text{C}$ |
| $T_{stg}$  |                                                                   | -55 ... +175    | $^\circ\text{C}$ |
| $T_L$      | Maximum Lead Temperature for Soldering                            | 300             | $^\circ\text{C}$ |
| $T_{SOLD}$ | Plastic Body for 10s                                              | 260             | $^\circ\text{C}$ |
| $M_d$      | Mounting Torque (TO-220)                                          | 1.13 / 10       | Nm/lb.in.        |
| Weight     | TO-263                                                            | 2.5             | g                |
|            | TO-220                                                            | 3.0             | g                |

TO-263AA (IXTA)



TO-220AB (IXTP)



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

### Features

- International Standard Packages
- 175°C Operating Temperature
- Avalanche Rated
- Low  $R_{DS(on)}$
- Fast Intrinsic Rectifier
- High Current Handling Capability

### Advantages

- Easy to Mount
- Space Savings
- High Power Density

### Applications

- Synchronous Rectification
- DC/DC Converters and Off-Line UPS
- Primary- Side Switch
- High Current Switching Applications

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) | Characteristic Values |      |               |
|--------------|---------------------------------------------------------------------------|-----------------------|------|---------------|
|              |                                                                           | Min.                  | Typ. | Max.          |
| $BV_{DSS}$   | $V_{GS} = 0V, I_D = 250\mu A$                                             | 120                   |      | V             |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\mu A$                                         | 2.5                   |      | 4.5 V         |
| $I_{GSS}$    | $V_{GS} = \pm 20V, V_{DS} = 0V$                                           |                       |      | $\pm 200$ nA  |
| $I_{DSS}$    | $V_{DS} = V_{DSS}, V_{GS} = 0V$<br>$T_J = 150^\circ\text{C}$              |                       |      | 10 $\mu A$    |
|              |                                                                           |                       |      | 500 $\mu A$   |
| $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 0.5 \cdot I_{D25}$ , Notes 1, 2                      | 8                     |      | 10 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                                                                                         | 66                    | 110  | S                      |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                   |                       | 9700 | pF                     |
| $C_{oss}$    |                                                                                                                                                    |                       | 850  | pF                     |
| $C_{rss}$    |                                                                                                                                                    |                       | 58   | pF                     |
| $t_{d(on)}$  | <b>Resistive Switching Times</b><br>$V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$<br>$R_G = 2\Omega$ (External) |                       | 27   | ns                     |
| $t_r$        |                                                                                                                                                    |                       | 30   | ns                     |
| $t_{d(off)}$ |                                                                                                                                                    |                       | 39   | ns                     |
| $t_f$        |                                                                                                                                                    |                       | 17   | ns                     |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                                                   |                       | 174  | nC                     |
| $Q_{gs}$     |                                                                                                                                                    |                       | 52   | nC                     |
| $Q_{gd}$     |                                                                                                                                                    |                       | 40   | nC                     |
| $R_{thJC}$   | TO-220                                                                                                                                             |                       | 0.50 | $0.26^\circ\text{C/W}$ |
| $R_{thCH}$   |                                                                                                                                                    |                       |      | $^\circ\text{C/W}$     |

### Source-Drain Diode

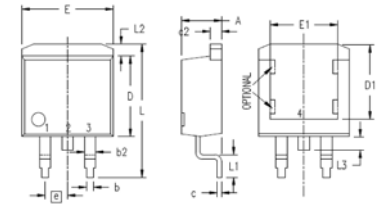
| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                  | Characteristic Values |      |       |
|----------|--------------------------------------------------------------------------------------------------------------|-----------------------|------|-------|
|          |                                                                                                              | Min.                  | Typ. | Max.  |
| $I_S$    | $V_{GS} = 0\text{V}$                                                                                         |                       |      | 140 A |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                                                  |                       |      | 560 A |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                                                  |                       |      | 1.4 V |
| $t_{rr}$ | $I_F = 0.5 \cdot I_{D25}$ , $V_{GS} = 0\text{V}$<br>$-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 60\text{V}$ |                       | 65   | ns    |
| $I_{RM}$ |                                                                                                              |                       | 13   | A     |
| $Q_{RM}$ |                                                                                                              |                       | 430  | nC    |

- 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 5mm or less from the package body.

### ADVANCE TECHNICAL INFORMATION

The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

### TO-263 Outline

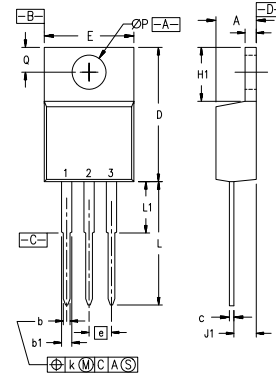


Pins:

- 1 - Gate  
2,4 - Drain  
3 - Source

| 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



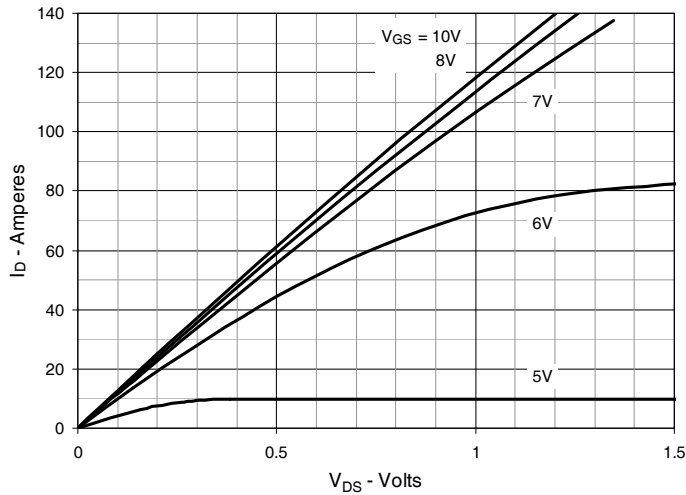
- Pins: 1 - Gate 2 - Drain  
3 - Source

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

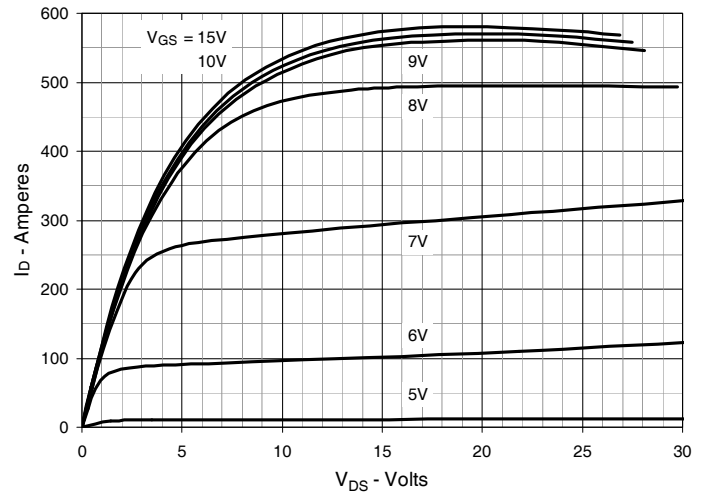
IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

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

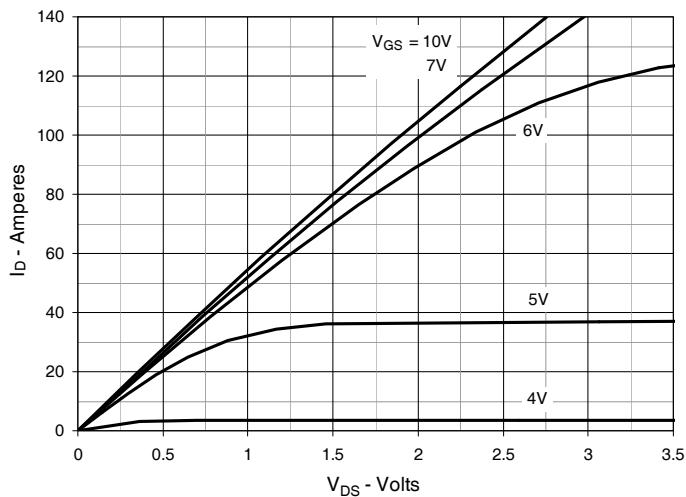
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$**



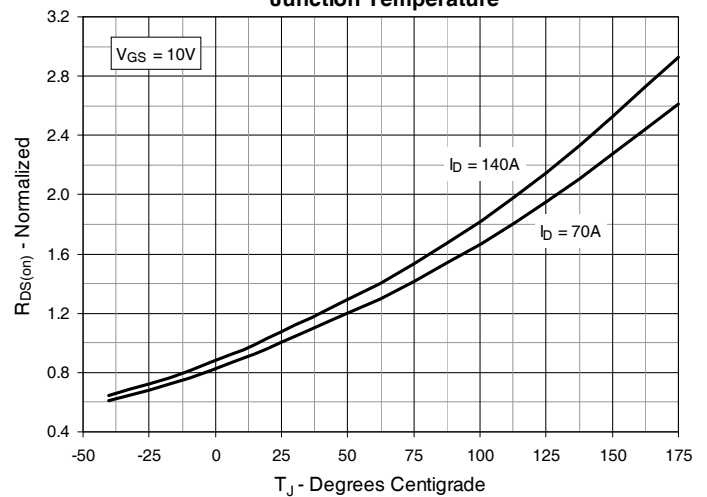
**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$**



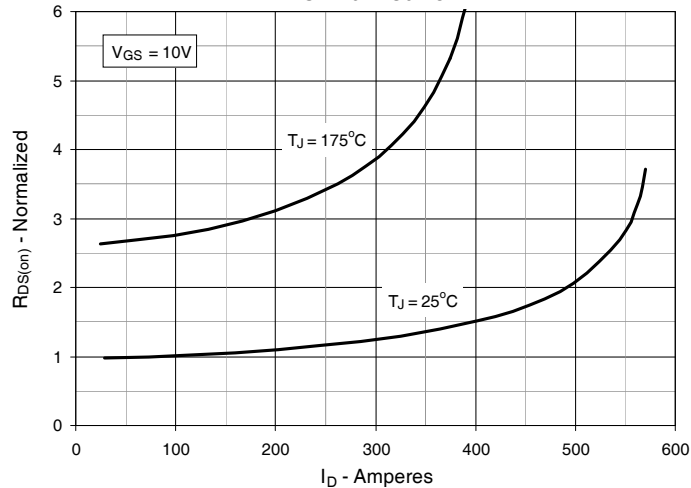
**Fig. 3. Output Characteristics @  $T_J = 150^\circ\text{C}$**



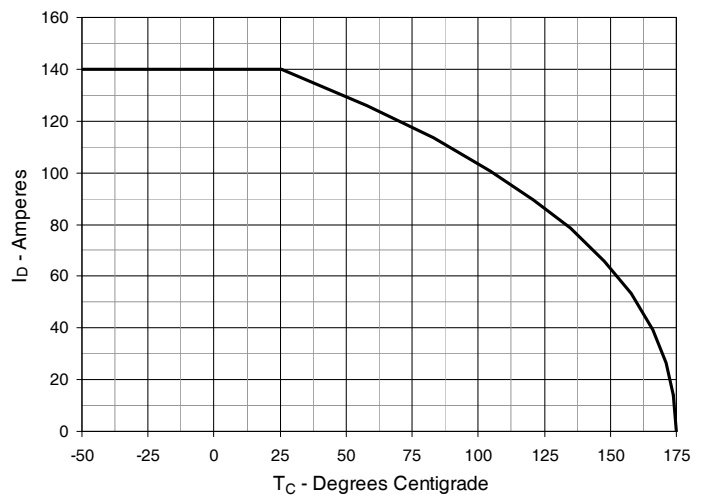
**Fig. 4. Normalized  $R_{DS(on)}$  to  $I_D = 70\text{A}$  Value vs. Junction Temperature**



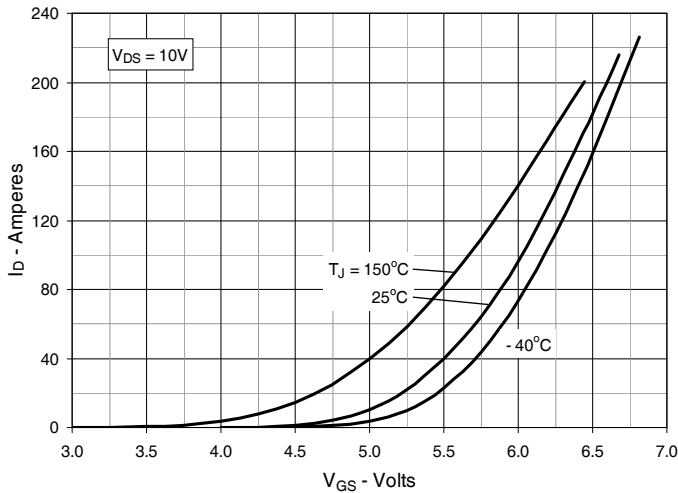
**Fig. 5. Normalized  $R_{DS(on)}$  to  $I_D = 70\text{A}$  vs. Drain Current**



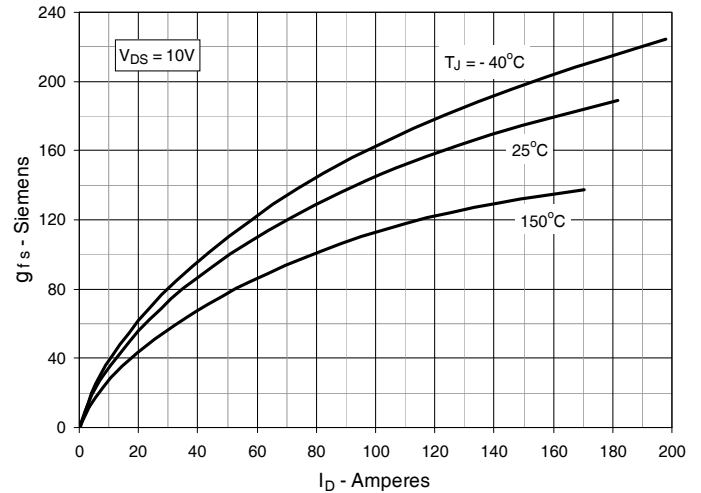
**Fig. 6. Drain Current vs. Case Temperature**



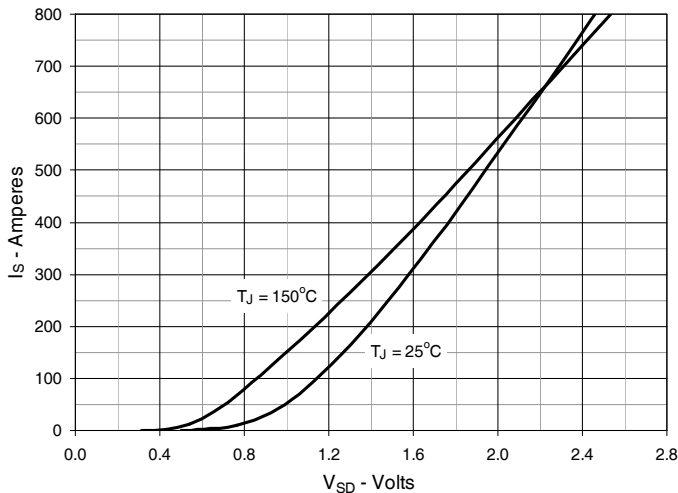
**Fig. 7. Input Admittance**



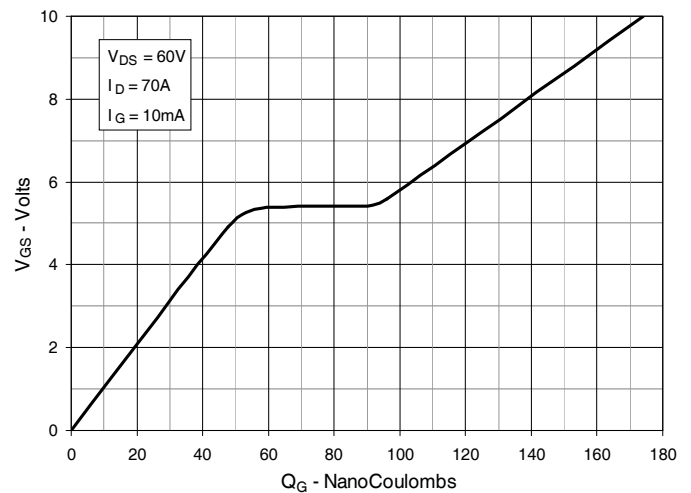
**Fig. 8. Transconductance**



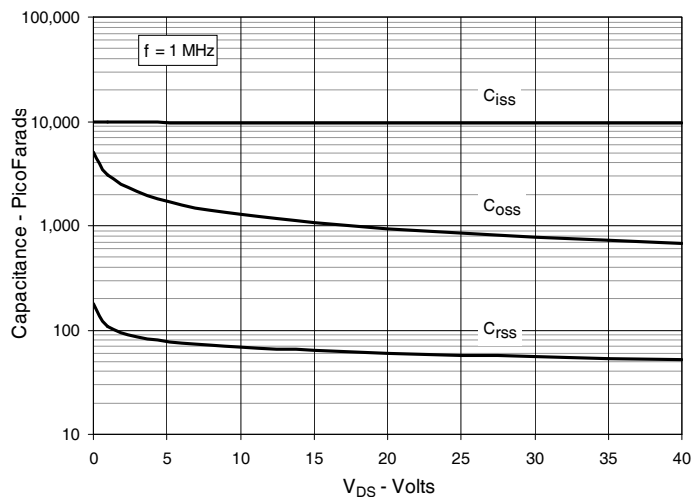
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



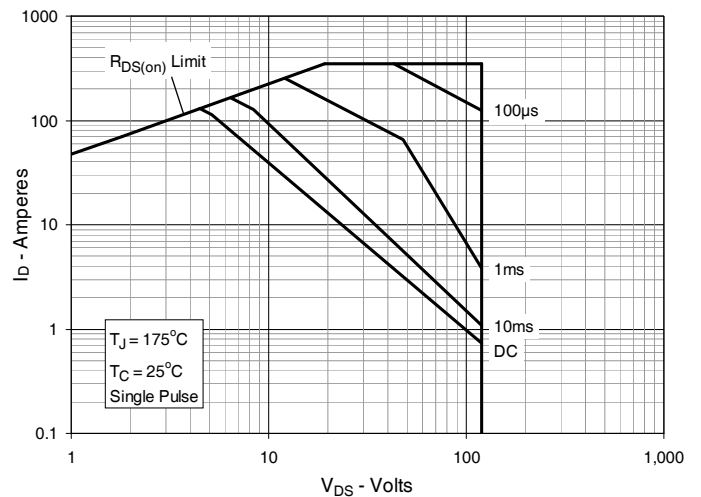
**Fig. 10. Gate Charge**



**Fig. 11. Capacitance**



**Fig. 12. Forward-Bias Safe Operating Area**



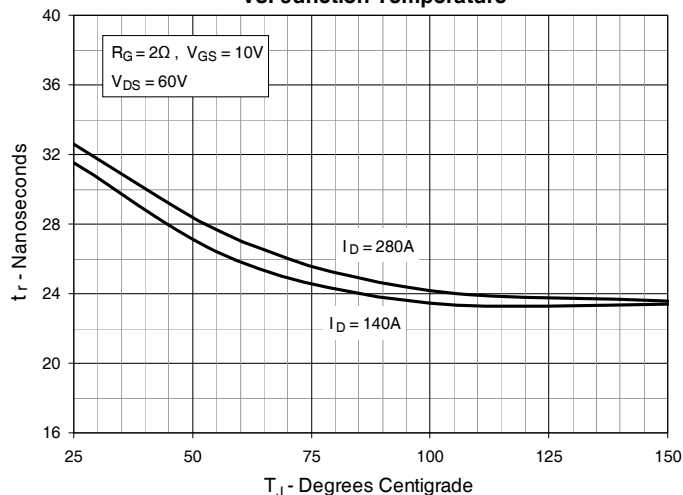
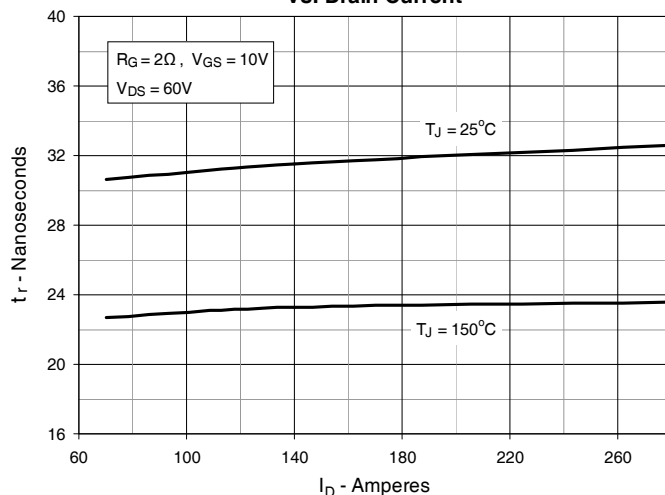
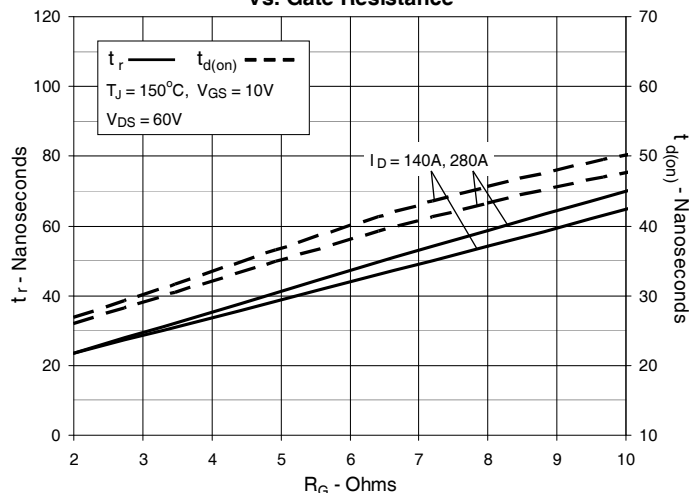
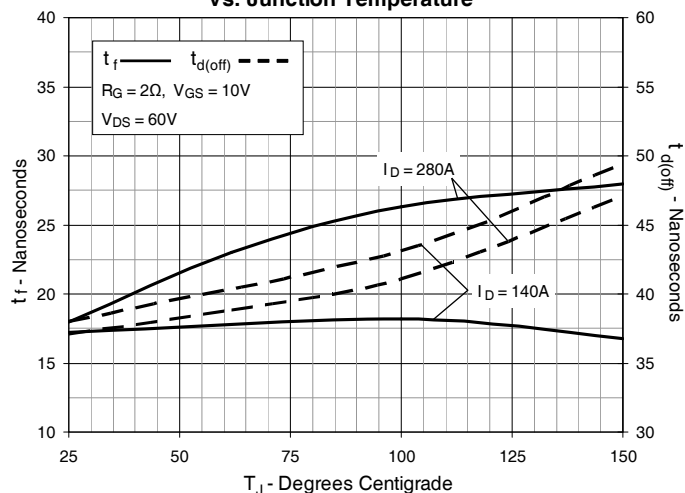
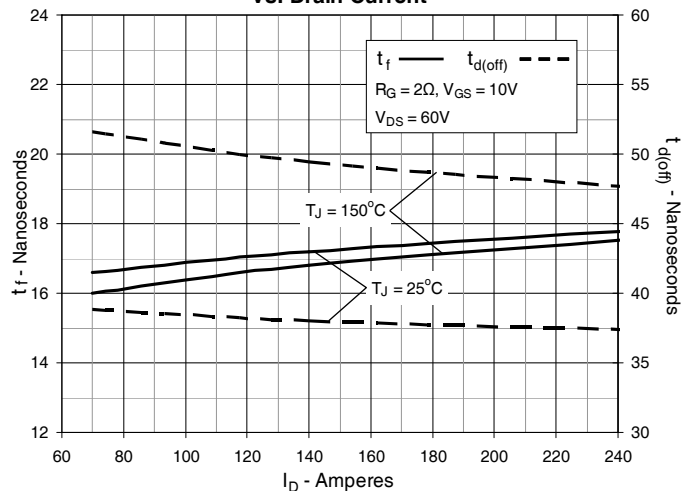
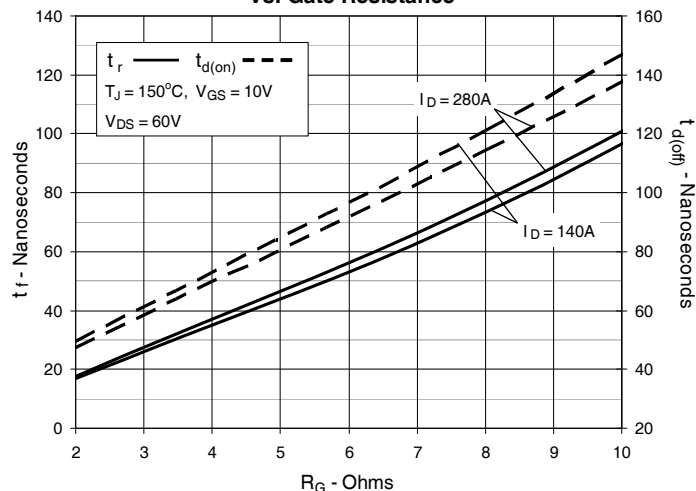
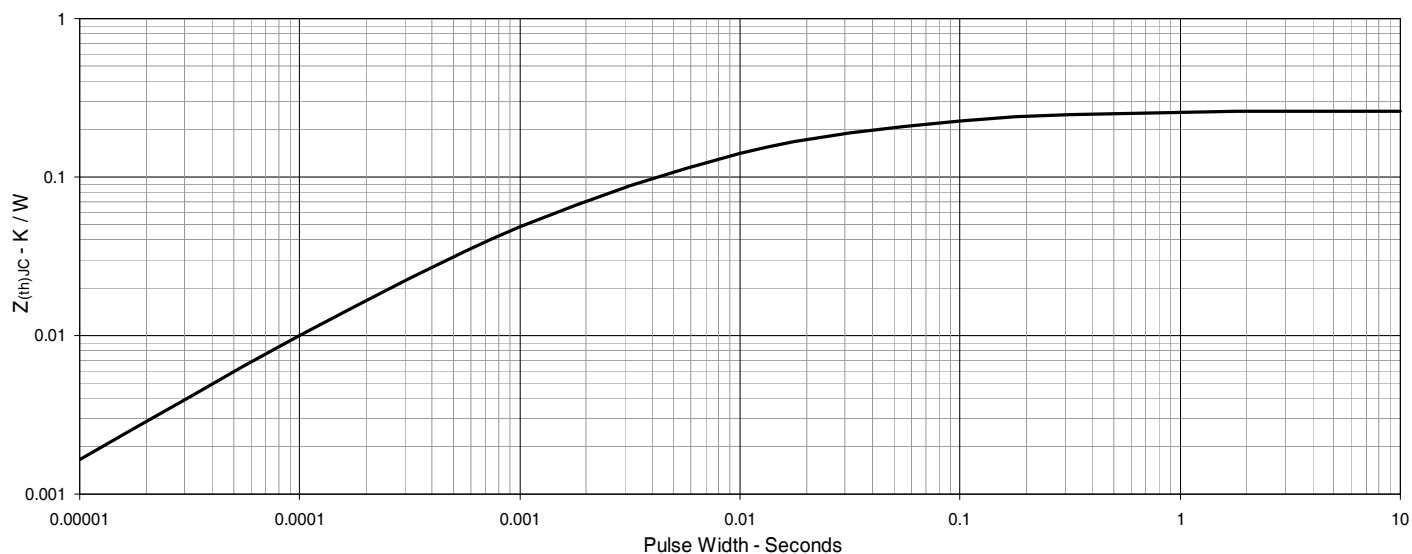
**Fig. 13. Resistive Turn-on Rise Time vs. Junction Temperature**

**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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