

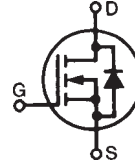
# HiPerFET™ Power MOSFETs Q-Class

**IXFH 21N50Q**  
**IXFT 21N50Q**

**$V_{DSS} = 500 \text{ V}$**   
 **$I_{D25} = 21 \text{ A}$**   
 **$R_{DS(on)} = 0.25 \Omega$**

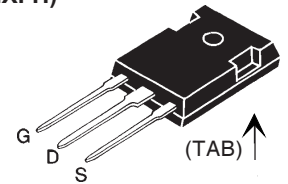
**$t_{rr} \leq 250 \text{ ns}$**

N-Channel Enhancement Mode  
Avalanche Rated, Low  $Q_g$ , High  $dv/dt$

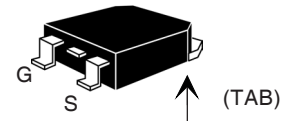


| Symbol    | Test Conditions                                                                                                                         | Maximum Ratings |                  |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$ | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                                                                                         | 500             | V                |
| $V_{DGR}$ | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ ; $R_{GS} = 1 \text{ M}\Omega$                                                          | 500             | V                |
| $V_{GS}$  | Continuous                                                                                                                              | $\pm 30$        | V                |
| $V_{GSM}$ | Transient                                                                                                                               | $\pm 40$        | V                |
| $I_{D25}$ | $T_C = 25^\circ\text{C}$                                                                                                                | 21              | A                |
| $I_{DM}$  | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$                                                                              | 84              | A                |
| $I_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 21              | A                |
| $E_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 30              | mJ               |
| $E_{AS}$  |                                                                                                                                         | 1.5             | mJ               |
| $dv/dt$   | $I_S \leq I_{DM}$ , $di/dt \leq 100 \text{ A}/\mu\text{s}$ , $V_{DD} \leq V_{DSS}$ ,<br>$T_J \leq 150^\circ\text{C}$ , $R_G = 2 \Omega$ | 15              | V/ns             |
| $P_D$     | $T_C = 25^\circ\text{C}$                                                                                                                | 280             | W                |
| $T_J$     |                                                                                                                                         | -55 to +150     | $^\circ\text{C}$ |
| $T_{JM}$  |                                                                                                                                         | 150             | $^\circ\text{C}$ |
| $T_{stg}$ |                                                                                                                                         | -55 to +150     | $^\circ\text{C}$ |
| $T_L$     | 1.6 mm (0.063 in) from case for 10 s                                                                                                    | 300             | $^\circ\text{C}$ |
| $M_d$     | Mounting torque                                                                                                                         | 1.13/10         | Nm/lb.in.        |
| Weight    | TO-247                                                                                                                                  | 6               | g                |
|           | TO-268                                                                                                                                  | 4               | g                |

TO-247 AD (IXFH)



TO-268 (D3) (IXFT)



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

## Features

- <sup>1</sup> IXYS advanced low  $Q_g$  process
- <sup>1</sup> Low gate charge and capacitances
  - easier to drive
  - faster switching
- <sup>1</sup> International standard packages
- <sup>1</sup> Low  $R_{DS(on)}$
- <sup>1</sup> Rated for unclamped Inductive load switching (UIS) rated
- <sup>1</sup> Molding epoxies meet UL 94 V-0 flammability classification

## Advantages

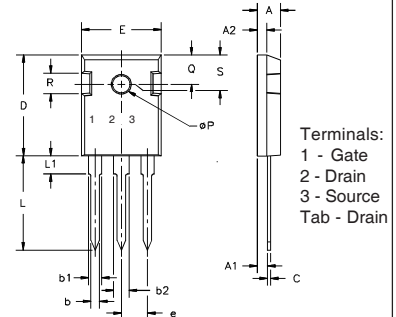
- <sup>1</sup> Easy to mount
- <sup>1</sup> Space savings
- <sup>1</sup> High power density

| Symbol       | Test Conditions                                                                                                  | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                      |
|--------------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|----------------------|
|              |                                                                                                                  | min.                                                                              | typ. | max.                 |
| $V_{DSS}$    | $V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$                                                                 | 500                                                                               |      | V                    |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 4 \text{ mA}$                                                                         | 2.5                                                                               |      | 4.5 V                |
| $I_{GSS}$    | $V_{GS} = \pm 30 \text{ V}_{DC}$ , $V_{DS} = 0$                                                                  |                                                                                   |      | $\pm 100 \text{ nA}$ |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$<br>$V_{GS} = 0 \text{ V}$                                                                     | $T_J = 25^\circ\text{C}$<br>$T_J = 125^\circ\text{C}$                             |      | 25 $\mu\text{A}$     |
|              |                                                                                                                  |                                                                                   |      | 1 mA                 |
| $R_{DS(on)}$ | $V_{GS} = 10 \text{ V}$ , $I_D = 0.5 I_{D25}$<br>Pulse test, $t \leq 300 \mu\text{s}$ , duty cycle $d \leq 2 \%$ |                                                                                   |      | 0.25 $\Omega$        |

| Symbol       | Test Conditions                                                                                                | Characteristic Values<br>(T <sub>J</sub> = 25°C, unless otherwise specified) |      |      |
|--------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------|------|
|              |                                                                                                                | min.                                                                         | typ. | max. |
| $g_{fs}$     | $V_{DS} = 20 \text{ V}; I_D = 0.5 \cdot I_{D25}$ , pulse test                                                  | 14                                                                           | 21   | S    |
| $C_{iss}$    | $V_{GS} = 0 \text{ V}, V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}$                                               |                                                                              | 3000 | pF   |
| $C_{oss}$    |                                                                                                                |                                                                              | 420  | pF   |
| $C_{rss}$    |                                                                                                                |                                                                              | 110  | pF   |
| $t_{d(on)}$  | $V_{GS} = 10 \text{ V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$<br>$R_G = 2.0 \Omega$ (External), |                                                                              | 25   | ns   |
| $t_r$        |                                                                                                                |                                                                              | 28   | ns   |
| $t_{d(off)}$ |                                                                                                                |                                                                              | 51   | ns   |
| $t_f$        |                                                                                                                |                                                                              | 12   | ns   |
| $Q_{g(on)}$  | $V_{GS} = 10 \text{ V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$                                   |                                                                              | 84   | nC   |
| $Q_{gs}$     |                                                                                                                |                                                                              | 20   | nC   |
| $Q_{gd}$     |                                                                                                                |                                                                              | 35   | nC   |
| $R_{thJC}$   | (TO-247)                                                                                                       |                                                                              | 0.45 | K/W  |
| $R_{thCK}$   |                                                                                                                |                                                                              | 0.25 | K/W  |

| Source-Drain Diode |                                                                                                        | Characteristic Values<br>(T <sub>J</sub> = 25°C, unless otherwise specified) |      |               |
|--------------------|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------|---------------|
| Symbol             | Test Conditions                                                                                        | min.                                                                         | typ. | max.          |
| $I_S$              | $V_{GS} = 0 \text{ V}$                                                                                 |                                                                              |      | 21 A          |
| $I_{SM}$           | Repetitive; pulse width limited by T <sub>JM</sub>                                                     |                                                                              |      | 84 A          |
| $V_{SD}$           | $I_F = I_S, V_{GS} = 0 \text{ V}$ ,<br>Pulse test, $t \leq 300 \mu\text{s}$ , duty cycle $d \leq 2 \%$ |                                                                              |      | 1.3 V         |
| $t_{rr}$           | $I_F = I_S, -di/dt = 100 \text{ A}/\mu\text{s}, V_R = 100 \text{ V}$                                   |                                                                              | 0.85 | 250 ns        |
| $Q_{RM}$           |                                                                                                        |                                                                              | 8    | $\mu\text{C}$ |
| $I_{RM}$           |                                                                                                        |                                                                              |      | A             |

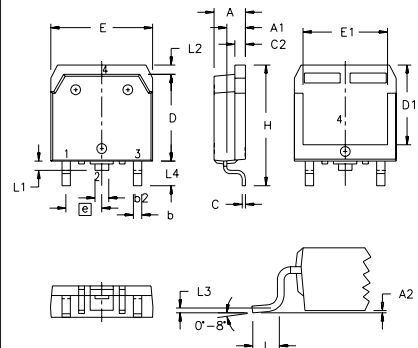
## TO-247 AD (IXFH) Outline



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  | .205   | .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  | .232   | .252 |
| R              | 4.32       | 5.49  | .170   | .216 |
| S              | 6.15       | BSC   | .242   | BSC  |

## TO-268 Outline



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

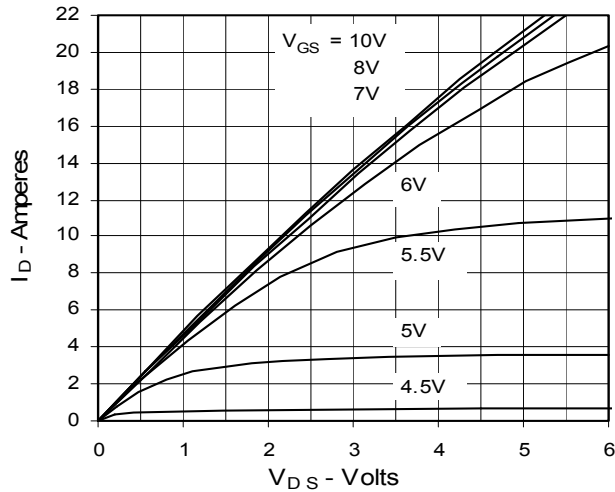
| SYM            | INCHES |      | MILLIMETERS |       |
|----------------|--------|------|-------------|-------|
|                | MIN    | MAX  | MIN         | MAX   |
| A              | .193   | .201 | 4.90        | 5.10  |
| A <sub>1</sub> | .106   | .114 | 2.70        | 2.90  |
| A <sub>2</sub> | .001   | .010 | 0.02        | 0.25  |
| b              | .045   | .057 | 1.15        | 1.45  |
| b <sub>2</sub> | .075   | .083 | 1.90        | 2.10  |
| C              | .016   | .026 | 0.40        | 0.65  |
| C <sub>2</sub> | .057   | .063 | 1.45        | 1.60  |
| D              | .543   | .551 | 13.80       | 14.00 |
| D <sub>1</sub> | .488   | .500 | 12.40       | 12.70 |
| E              | .624   | .632 | 15.85       | 16.05 |
| E <sub>1</sub> | .524   | .535 | 13.30       | 13.60 |
| e              | .215   | BSC  | 5.45        | BSC   |
| H              | .736   | .752 | 18.70       | 19.10 |
| L              | .094   | .106 | 2.40        | 2.70  |
| L <sub>1</sub> | .047   | .055 | 1.20        | 1.40  |
| L <sub>2</sub> | .039   | .045 | 1.00        | 1.15  |
| L <sub>3</sub> | .010   | BSC  | 0.25        | BSC   |
| L <sub>4</sub> | .150   | .161 | 3.80        | 4.10  |

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

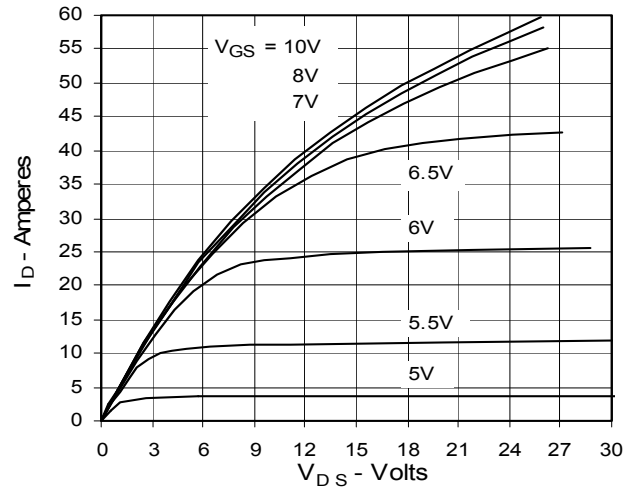
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |           |           |             |             |             |           |
|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-----------|
| 4,850,072 | 4,931,844 | 5,034,796 | 5,063,307 | 5,237,481 | 5,381,025 | 6,404,065B1 | 6,162,665   | 6,534,343   | 6,583,505 |
| 4,835,592 | 4,881,106 | 5,017,508 | 5,049,961 | 5,187,117 | 5,486,715 | 6,306,728B1 | 6,259,123B1 | 6,306,728B1 | 6,683,344 |

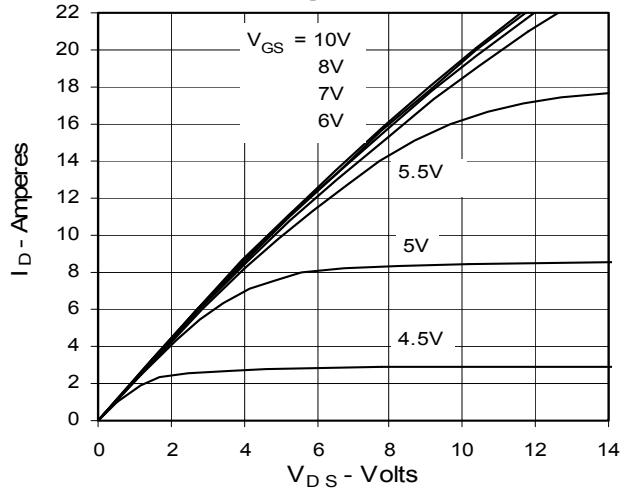
**Fig. 1. Output Characteristics  
@ 25°C**



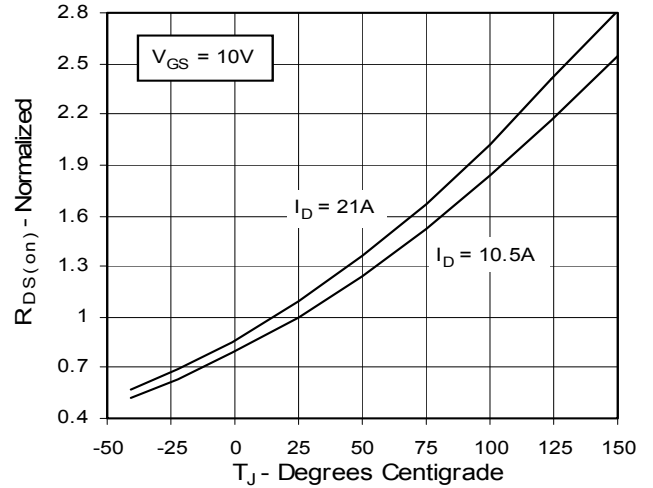
**Fig. 2. Extended Output Characteristics  
@ 25°C**



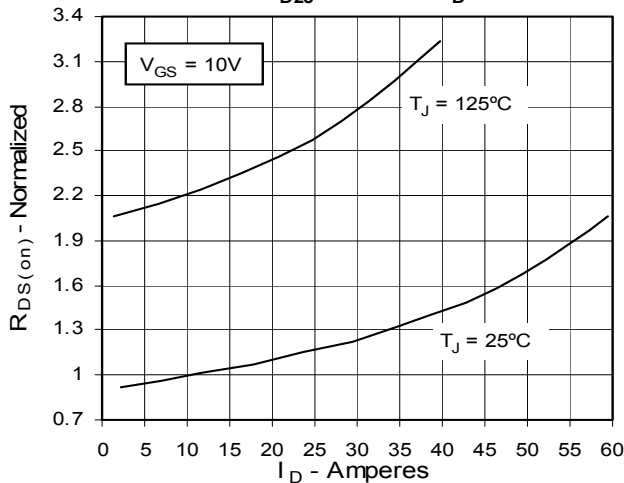
**Fig. 3. Output Characteristics  
@ 125°C**



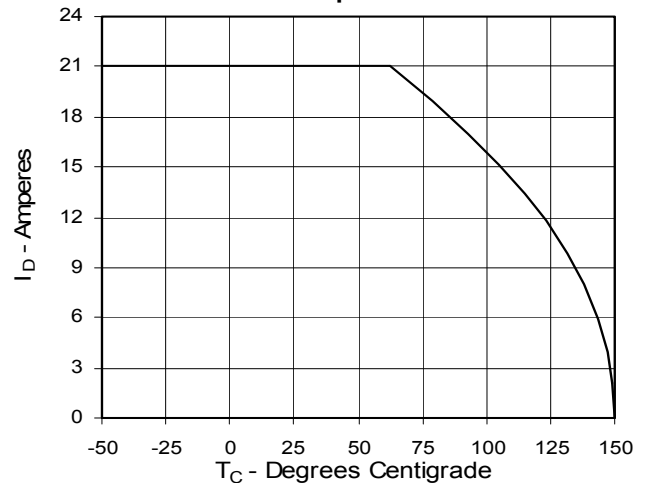
**Fig. 4.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$   
Value vs. Junction Temperature**

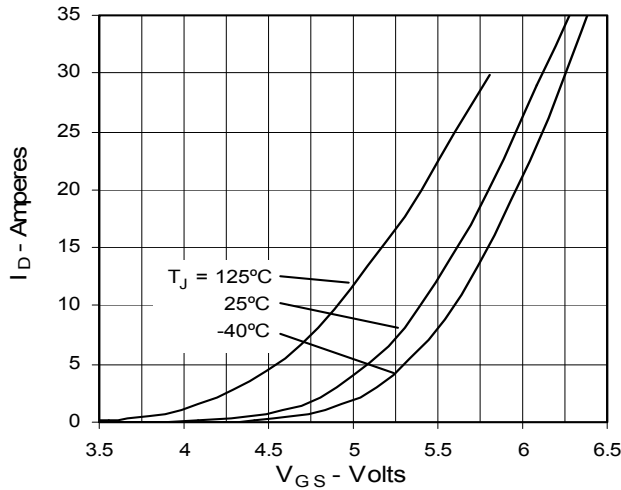
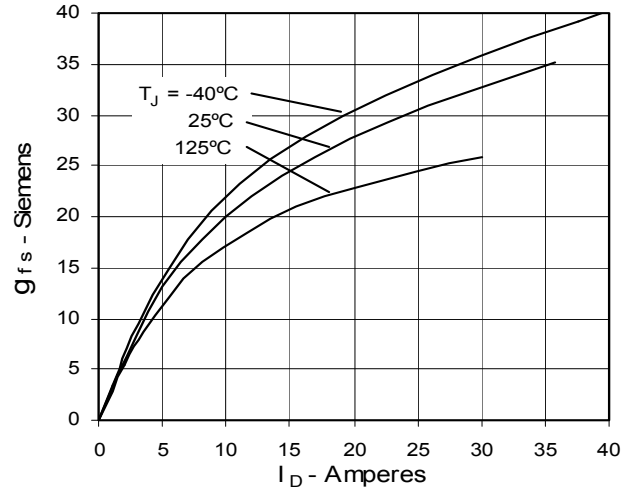
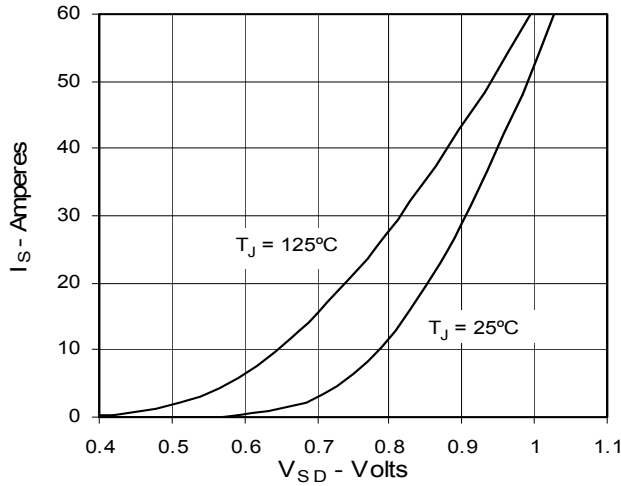
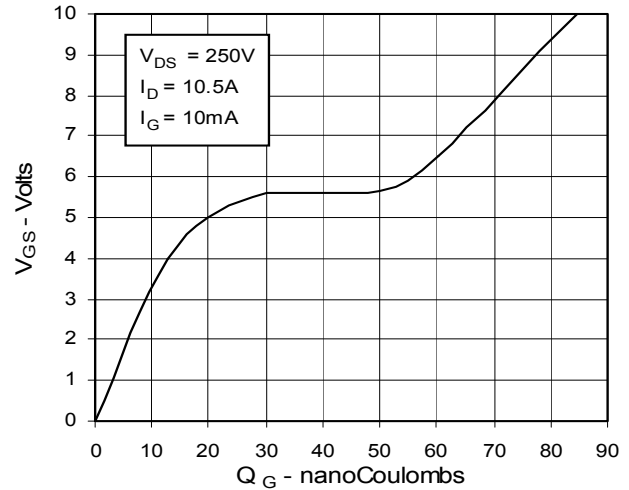
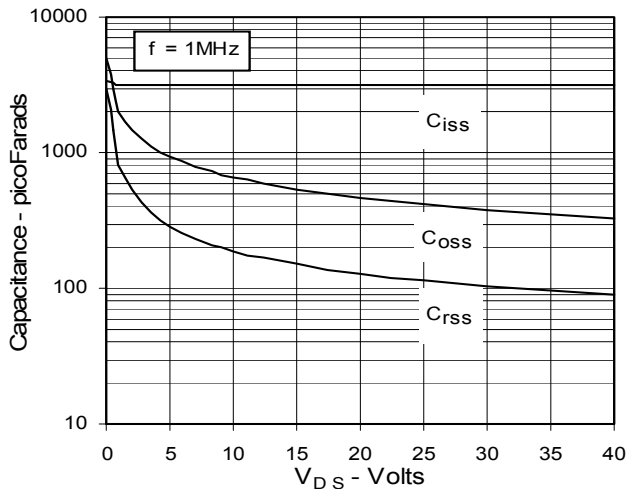
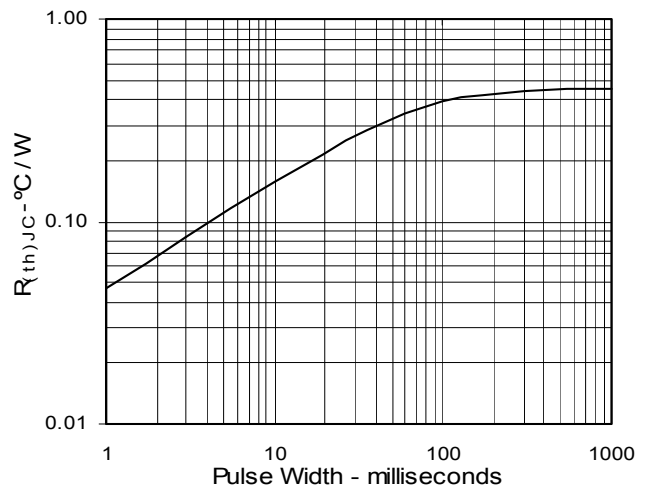


**Fig. 5.  $R_{DS(on)}$  Normalized to  
0.5  $I_{D25}$  Value vs.  $I_D$**



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



**Fig. 7. Input Admittance**

**Fig. 8. Transconductance**

**Fig. 9. Source Current vs. Source-To-Drain Voltage**

**Fig. 10. Gate Charge**

**Fig. 11. Capacitance**

**Fig. 12. Maximum Transient Thermal Resistance**


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|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-----------|
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| 4,835,592 | 4,881,106 | 5,017,508 | 5,049,961 | 5,187,117 | 5,486,715 | 6,306,728B1 | 6,259,123B1 | 6,306,728B1 | 6,683,344 |



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