

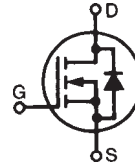
# Power MOSFETs

## Q-Class

**IXTH 24N50Q**  
**IXTT 24N50Q**

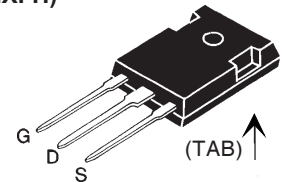
**$V_{DSS} = 500 \text{ V}$**   
 **$I_{D25} = 24 \text{ A}$**   
 **$R_{DS(on)} = 0.24 \Omega$**

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

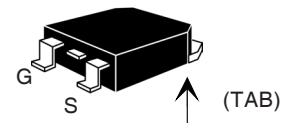


| Symbol    | Test Conditions                                                                                                                         | Maximum Ratings |                  |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$ | $T_J = 25^\circ\text{C}$ 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                |
| $I_{D25}$ | $T_C = 25^\circ\text{C}$                                                                                                                | 24              | A                |
| $I_{DM}$  | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$                                                                              | 96              | A                |
| $I_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 24              | A                |
| $E_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 30              | mJ               |
| $E_{AS}$  |                                                                                                                                         | 1.5             | J                |
| $dv/dt$   | $I_S \leq I_{DM}$ , $di/dt \leq 100 \text{ A}/\mu\text{s}$ , $V_{DD} \leq V_{DSS}$ ,<br>$T_J \leq 150^\circ\text{C}$ , $R_G = 2 \Omega$ | 10              | V/ns             |
| $P_D$     | $T_C = 25^\circ\text{C}$                                                                                                                | 360             | 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

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

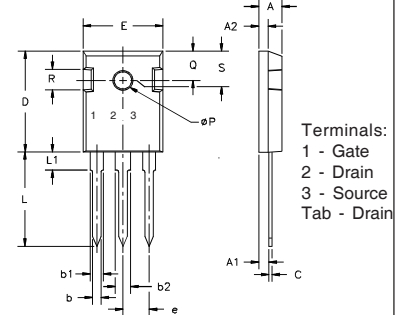
### Advantages

- Easy to mount
- Space savings
- High power density

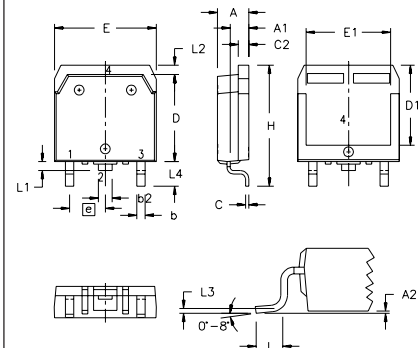
| Symbol       | Test Conditions                                                                                                  | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                          |
|--------------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|--------------------------|
|              |                                                                                                                  | min.                                                                              | typ. | max.                     |
| $V_{DSS}$    | $V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$                                                                 | 500                                                                               |      | V                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$                                                                      | 2.5                                                                               |      | 4.5 V                    |
| $I_{GSS}$    | $V_{GS} = \pm 30 \text{ V}_{DC}$ , $V_{DS} = 0$                                                                  |                                                                                   |      | $\pm 100 \text{ nA}$     |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0 \text{ V}$                                                                      |                                                                                   |      | 25 $\mu\text{A}$<br>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 $d \leq 2 \%$ |                                                                                   | 0.20 | 0.24 $\Omega$            |

| Symbol       | Test Conditions                                                                                                | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |      |
|--------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|------|
|              |                                                                                                                | min.                                                                              | typ. | max. |
| $g_{fs}$     | $V_{DS} = 20\text{ V}; I_D = 0.5 \cdot I_{D25}, \text{ pulse test}$                                            | 14                                                                                | 19   | S    |
| $C_{iss}$    | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                                  |                                                                                   | 3000 | pF   |
| $C_{oss}$    |                                                                                                                |                                                                                   | 410  | 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), |                                                                                   | 16   | ns   |
| $t_r$        |                                                                                                                |                                                                                   | 20   | ns   |
| $t_{d(off)}$ |                                                                                                                |                                                                                   | 46   | ns   |
| $t_f$        |                                                                                                                |                                                                                   | 11   | ns   |
| $Q_{g(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$                                    |                                                                                   | 82   | nC   |
| $Q_{gs}$     |                                                                                                                |                                                                                   | 18   | nC   |
| $Q_{gd}$     |                                                                                                                |                                                                                   | 36   | nC   |
| $R_{thJC}$   | (TO-247)                                                                                                       |                                                                                   | 0.35 | K/W  |
| $R_{thCK}$   |                                                                                                                |                                                                                   | 0.25 | K/W  |

| Source-Drain Diode |                                                                                                      | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |               |
|--------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|---------------|
| Symbol             | Test Conditions                                                                                      | min.                                                                              | typ. | max.          |
| $I_S$              | $V_{GS} = 0\text{ V}$                                                                                |                                                                                   |      | 24 A          |
| $I_{SM}$           | Repetitive; pulse width limited by $T_{JM}$                                                          |                                                                                   |      | 96 A          |
| $V_{SD}$           | $I_F = I_S, V_{GS} = 0\text{ V},$<br>Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $d \leq 2\%$ |                                                                                   |      | 1.5 V         |
| $t_{rr}$           | $I_F = I_S, -di/dt = 100\text{ A}/\mu\text{s}, V_R = 100\text{ V}$                                   |                                                                                   | 500  | ns            |
| $Q_{RM}$           |                                                                                                      |                                                                                   | 6.0  | $\mu\text{C}$ |

**TO-247 AD (IXFH) Outline**


| 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-268 Outline**


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

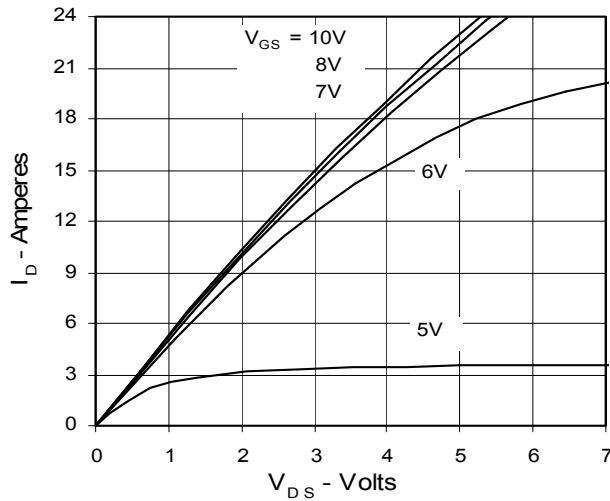
| SYM | INCHES |      | MILLIMETERS |       |
|-----|--------|------|-------------|-------|
|     | MIN    | MAX  | MIN         | MAX   |
| A   | .193   | .201 | 4.90        | 5.10  |
| A1  | .106   | .114 | 2.70        | 2.90  |
| A2  | .001   | .010 | 0.02        | 0.25  |
| b   | .045   | .057 | 1.15        | 1.45  |
| b2  | .075   | .083 | 1.90        | 2.10  |
| C   | .016   | .026 | 0.40        | 0.65  |
| C2  | .057   | .063 | 1.45        | 1.60  |
| D   | .543   | .551 | 13.80       | 14.00 |
| D1  | .488   | .500 | 12.40       | 12.70 |
| E   | .624   | .632 | 15.85       | 16.05 |
| E1  | .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  |
| L1  | .047   | .055 | 1.20        | 1.40  |
| L2  | .039   | .045 | 1.00        | 1.15  |
| L3  | .010   | BSC  | 0.25        | BSC   |
| L4  | .150   | .161 | 3.80        | 4.10  |

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

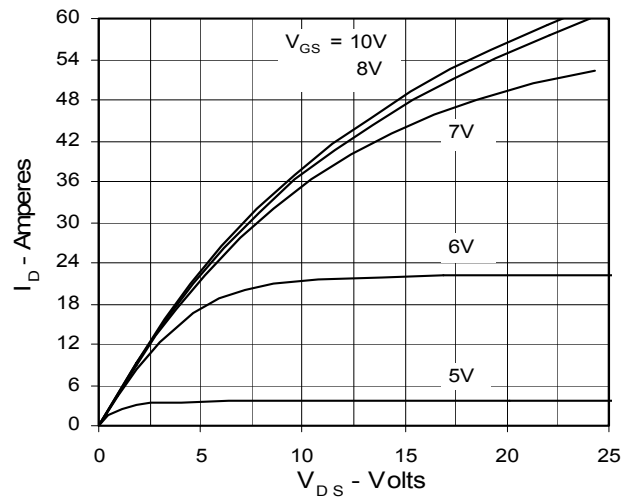
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

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

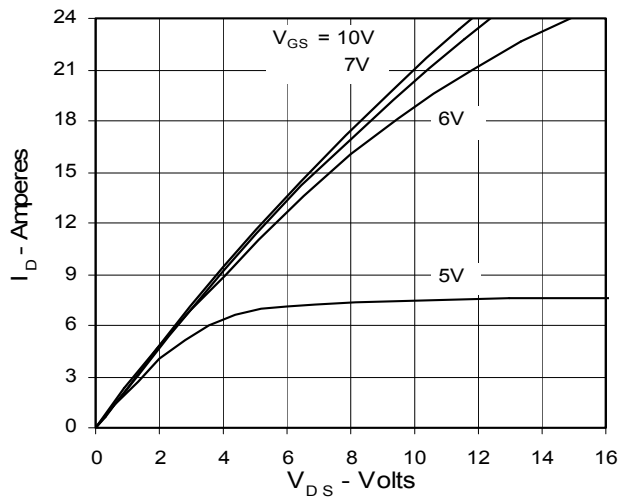
**Fig. 1. Output Characteristics  
@ 25 Deg. C**



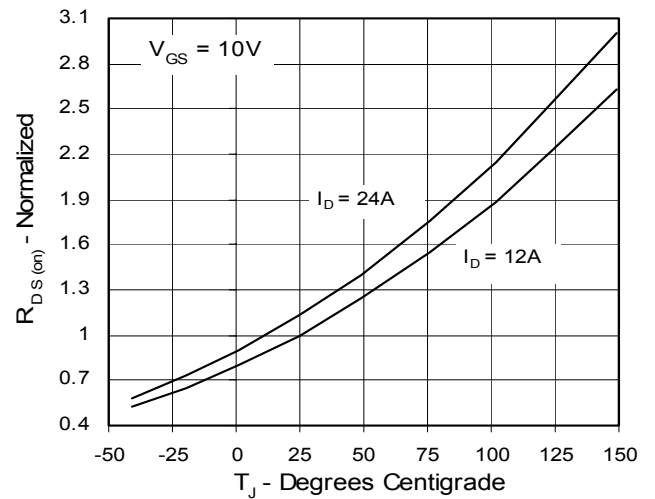
**Fig. 2. Extended Output Characteristics  
@ 25 deg. C**



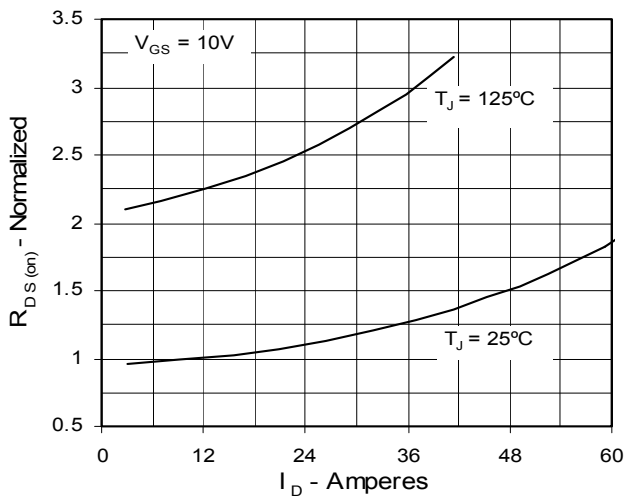
**Fig. 3. Output Characteristics  
@ 125 Deg. C**



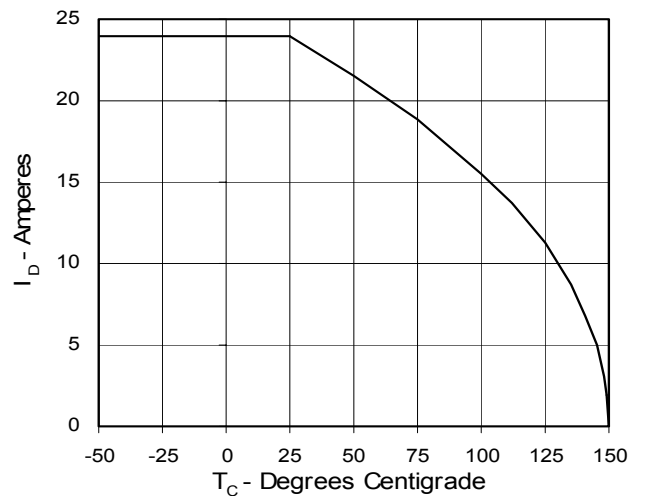
**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_{D25}$  Value vs.  
Junction Temperature**

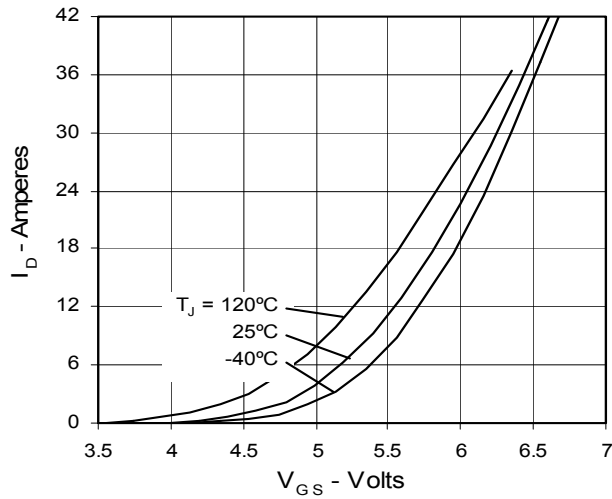
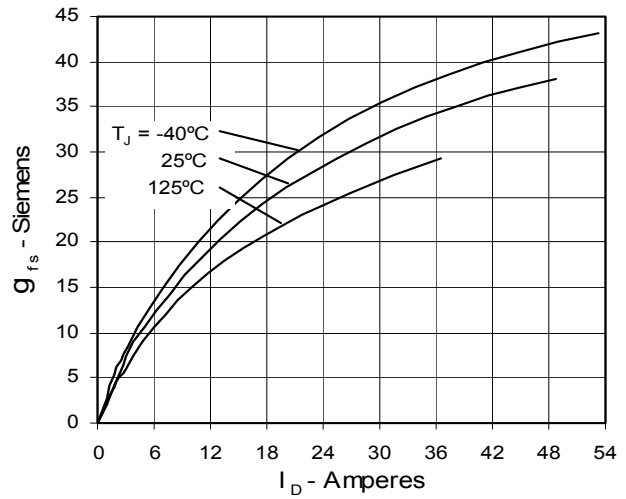
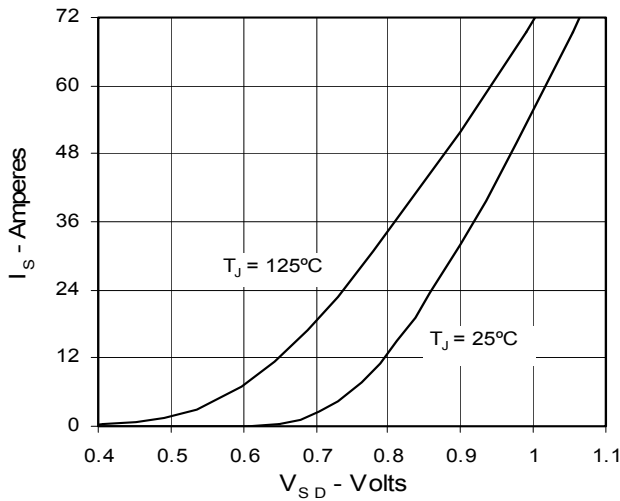
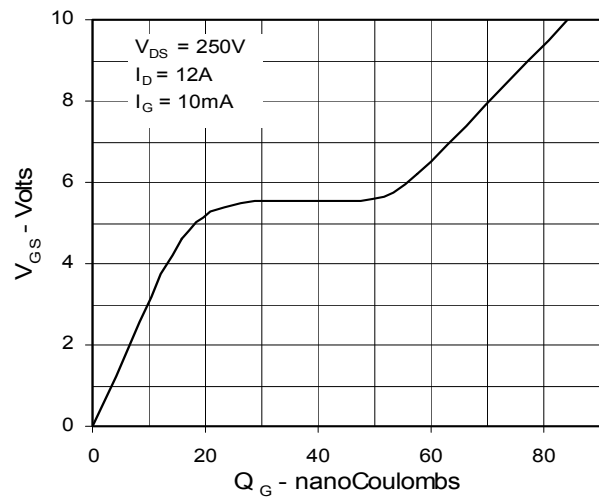
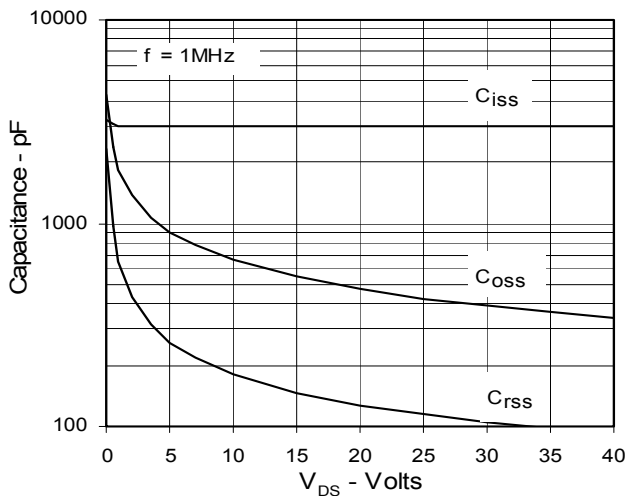
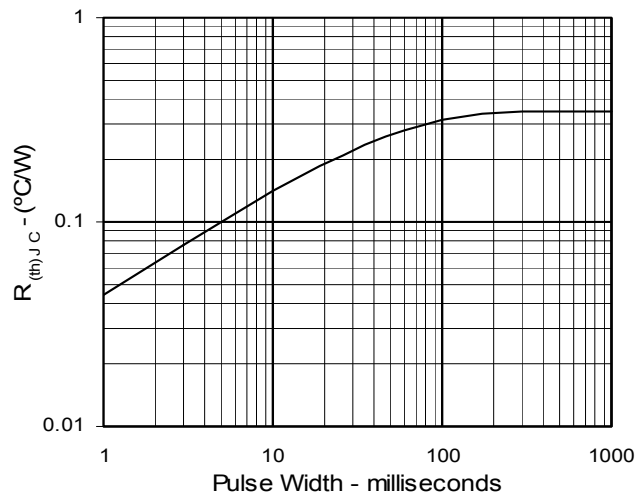


**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_{D25}$   
Value vs.  $I_D$**



**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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|           |           |           |           |           |           |             |             |             |
|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| 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 |
| 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   |