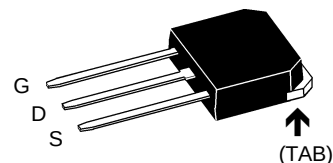
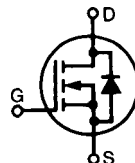


# HiPerFET™ Power MOSFETs

N-Channel Enhancement Mode  
High dv/dt, Low  $t_{rr}$ , HDMOS™ Family

## IXFJ 13N50

$V_{DSS} = 500 \text{ V}$   
 $I_{D(cont)} = 13 \text{ A}$   
 $R_{DS(on)} = 0.4 \Omega$   
 $t_{rr} \leq 250 \text{ ns}$



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

| Symbol    | Test Conditions                                                                                                                         | Maximum Ratings |                  |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$ | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                                                                                         | 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                                                                                                                              | $\pm 20$        | V                |
| $V_{GSM}$ | Transient                                                                                                                               | $\pm 30$        | V                |
| $I_{D25}$ | $T_C = 25^\circ\text{C}$                                                                                                                | 13              | A                |
| $I_{DM}$  | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$                                                                              | 52              | A                |
| $I_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 13              | A                |
| $E_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 18              | mJ               |
| dv/dt     | $I_S \leq I_{DM}$ , $di/dt \leq 100 \text{ A}/\mu\text{s}$ , $V_{DD} \leq V_{DSS}$ ,<br>$T_J \leq 150^\circ\text{C}$ , $R_G = 2 \Omega$ | 5               | V/ns             |
| $P_D$     | $T_C = 25^\circ\text{C}$                                                                                                                | 180             | W                |
| $T_J$     |                                                                                                                                         | -55 ... +150    | $^\circ\text{C}$ |
| $T_{JM}$  |                                                                                                                                         | 150             | $^\circ\text{C}$ |
| $T_{stg}$ |                                                                                                                                         | -55 ... +150    | $^\circ\text{C}$ |
| $T_L$     | 1.6 mm (0.062 in.) from case for 10 s                                                                                                   | 300             | $^\circ\text{C}$ |
| Weight    |                                                                                                                                         | 5               | g                |

### Features

- Low profile, high power package
- Long creep and strike distances
- Easy up-grade path for TO-220 designs
- Low  $R_{DS(on)}$  HDMOS™ process
- Rugged polysilicon gate cell structure
- Unclamped Inductive Switching (UIS) rated
- Low package inductance
  - easy to drive and to protect
- Fast intrinsic Rectifier

### Applications

- DC-DC converters
- Synchronous rectification
- Battery chargers
- Switched-mode and resonant-mode power supplies
- DC choppers
- AC motor control
- Temperature and lighting controls
- Low voltage relays

### Advantages

- High power, low profile package
- Space savings
- High power density

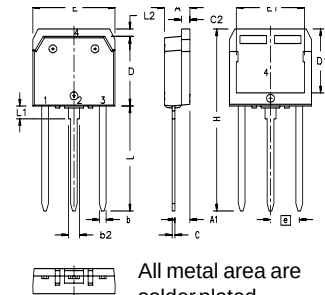
| Symbol       | Test Conditions                                                                                                        | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                           |
|--------------|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|---------------------------|
|              |                                                                                                                        | min.                                                                              | typ. | max.                      |
| $V_{DSS}$    | $V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$                                                                       | 500                                                                               |      | V                         |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 2.5 \text{ mA}$                                                                             | 2                                                                                 |      | V                         |
| $I_{GSS}$    | $V_{GS} = \pm 20 \text{ V}_{DC}$ , $V_{DS} = 0$                                                                        |                                                                                   |      | $\pm 100 \text{ nA}$      |
| $I_{DSS}$    | $V_{DS} = 0.8 \cdot V_{DSS}$ , $V_{GS} = 0 \text{ V}$                                                                  |                                                                                   |      | 200 $\mu\text{A}$<br>1 mA |
| $R_{DS(on)}$ | $V_{GS} = 10 \text{ V}$ , $I_D = 0.5 \cdot I_{D25}$<br>Pulse test, $t \leq 300 \mu\text{s}$ , duty cycle $d \leq 2 \%$ |                                                                                   |      | 0.4 $\Omega$              |

| Symbol       | Test Conditions                                                                                                       | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |        |
|--------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|--------|
|              |                                                                                                                       | min.                                                                              | typ. | max.   |
| $g_{fs}$     | $V_{DS} = 10\text{ V}$ ; $I_D = 0.5 I_{D25}$ , pulse test                                                             | 7.5                                                                               | 9.0  | S      |
| $C_{iss}$    | $V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                                                   |                                                                                   | 2800 | pF     |
| $C_{oss}$    |                                                                                                                       |                                                                                   | 300  | pF     |
| $C_{rss}$    |                                                                                                                       |                                                                                   | 70   | pF     |
| $t_{d(on)}$  | $V_{GS} = 10\text{ V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ ,<br>$I_D = 0.5 \cdot I_{D25}$ , $R_G = 4.7\ \Omega$ (External) |                                                                                   | 18   | 30 ns  |
| $t_r$        |                                                                                                                       |                                                                                   | 27   | 40 ns  |
| $t_{d(off)}$ |                                                                                                                       |                                                                                   | 76   | 100 ns |
| $t_f$        |                                                                                                                       |                                                                                   | 32   | 60 ns  |
| $Q_{g(on)}$  | $V_{GS} = 10\text{ V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                     |                                                                                   | 110  | 120 nC |
| $Q_{gs}$     |                                                                                                                       |                                                                                   | 15   | 25 nC  |
| $Q_{gd}$     |                                                                                                                       |                                                                                   | 40   | 50 nC  |
| $R_{thJC}$   |                                                                                                                       |                                                                                   | 0.7  | K/W    |
| $R_{thCK}$   |                                                                                                                       | 0.25                                                                              |      | K/W    |

## Source-Drain Diode

| Symbol   | Test Conditions                                                                                          | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |               |
|----------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|---------------|
|          |                                                                                                          | min.                                                                              | typ. | max.          |
| $I_S$    | $V_{GS} = 0\text{ V}$                                                                                    |                                                                                   |      | 13 A          |
| $I_{SM}$ | Repetitive; pulse width limited by $T_{JM}$                                                              |                                                                                   |      | 52 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         |
| $t_{rr}$ | $I_F = I_S$ ,<br>$-di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_R = 100\text{ V}$                           | $T_J = 25^\circ\text{C}$                                                          |      | 250 ns        |
|          |                                                                                                          | $T_J = 125^\circ\text{C}$                                                         |      | 350 ns        |
| $Q_{RM}$ |                                                                                                          | $T_J = 25^\circ\text{C}$                                                          | 0.6  | $\mu\text{C}$ |
|          |                                                                                                          | $T_J = 125^\circ\text{C}$                                                         | 1.25 | $\mu\text{C}$ |
| $I_{RM}$ |                                                                                                          | $T_J = 25^\circ\text{C}$                                                          | 9    | A             |
|          |                                                                                                          | $T_J = 125^\circ\text{C}$                                                         | 15   | A             |

## TO-268 Outline



All metal area are solder plated  
 1 - gate  
 2 - drain (collector)  
 3 - source (emitter)  
 4 - drain (collector)

| Dim. | Inches   |       | Millimeters |       |
|------|----------|-------|-------------|-------|
|      | Min      | Max   | Min         | Max   |
| A    | .193     | .201  | 4.90        | 5.10  |
| A1   | .106     | .114  | 2.70        | 2.90  |
| b    | .045     | .057  | 1.15        | 1.45  |
| b2   | .075     | .083  | 1.90        | 2.10  |
| C    | .016     | .026  | .040        | .065  |
| 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    | 1.365    | 1.395 | 34.67       | 35.43 |
| L    | .780     | .800  | 19.81       | 20.32 |
| L1   | .079     | .091  | 2.00        | 2.30  |
| L2   | .039     | .045  | 1.00        | 1.15  |

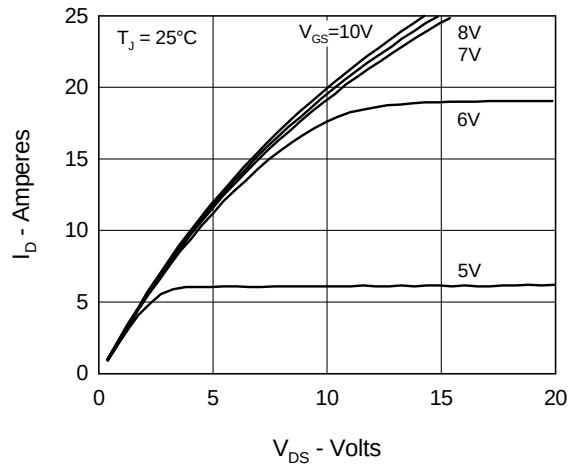


Figure 1. Output Characteristics at 25°C

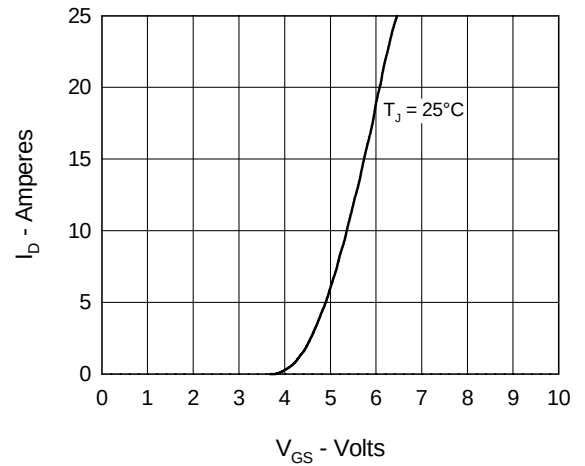


Figure 2. Output Characteristics at 125°C

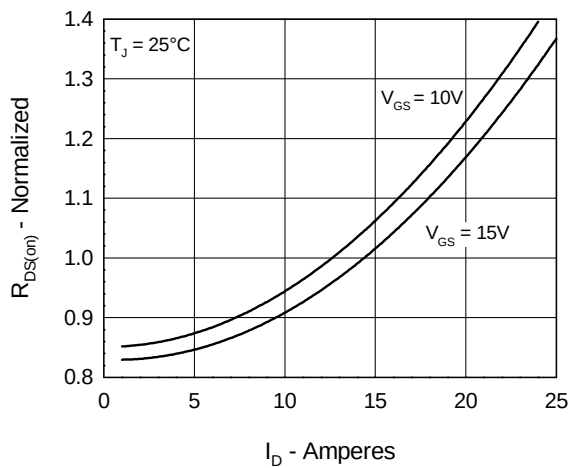


Figure 3.  $R_{DS(on)}$  normalized to 0.5  $I_{D25}$  value

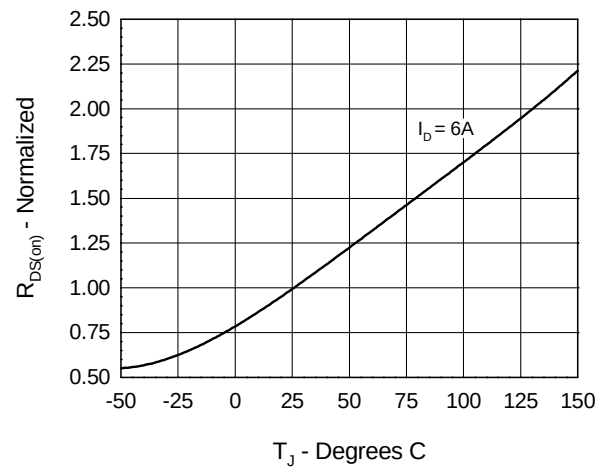


Figure 4.  $R_{DS(on)}$  normalized to 0.5  $I_{D25}$  value

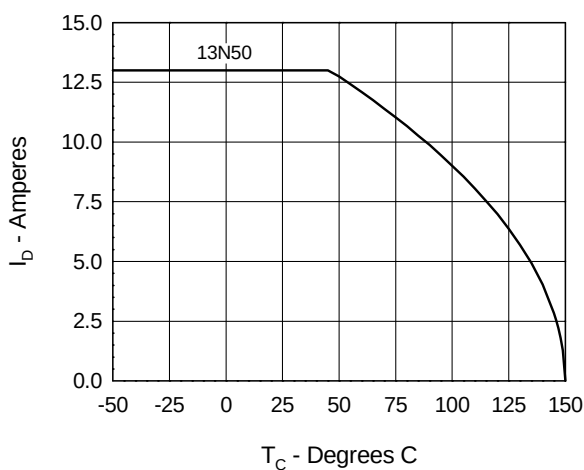


Figure 5. Drain Current vs. Case Temperature

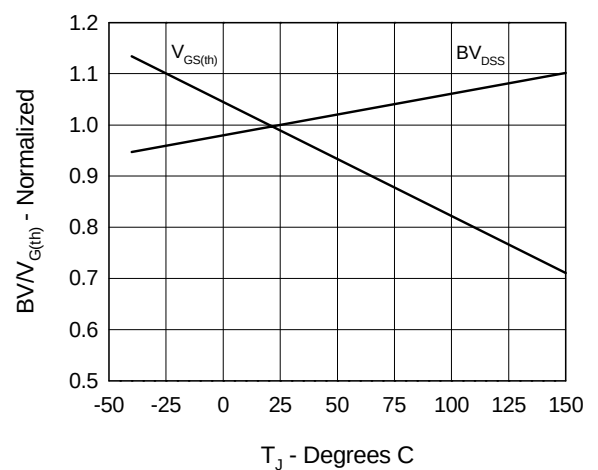


Figure 6. Admittance Curves

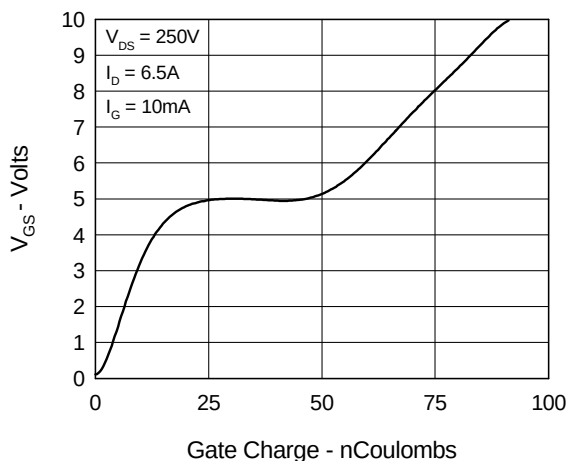


Figure 7. Gate Charge

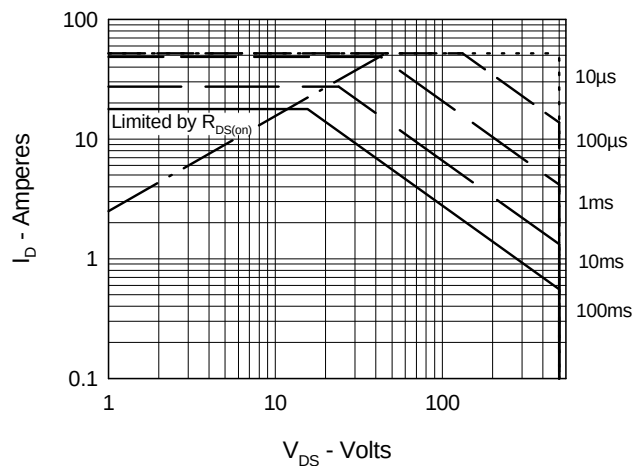


Figure 8. Capacitance Curves

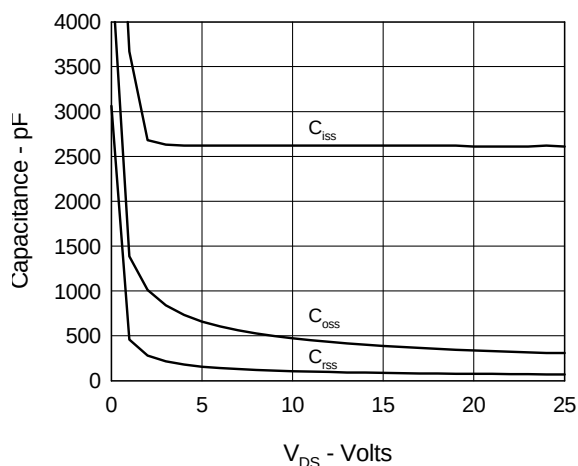


Figure 9. Source Current vs. Source to Drain Voltage

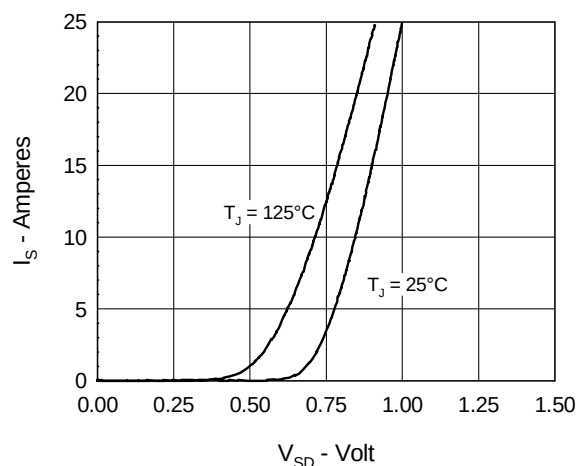


Figure 10. Forward Bias Safe Operating Area

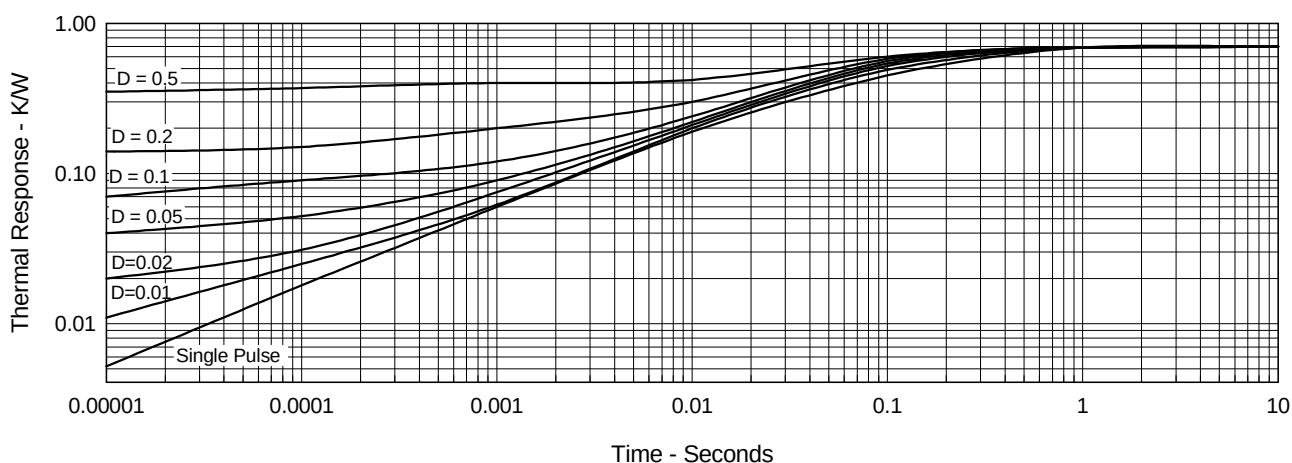


Figure 11. Transient Thermal Resistance