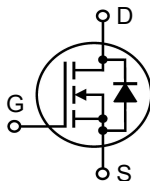


# X3-Class HiPerFET™ Power MOSFET

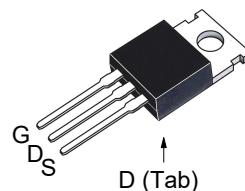
## IXFP36N60X3

$$\begin{aligned} V_{DSS} &= 600V \\ I_{D25} &= 36A \\ R_{DS(on)} &\leq 90m\Omega \end{aligned}$$

N-Channel Enhancement Mode  
Avalanche Rated



TO-220  
(IXFP)



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

| Symbol    | Test Conditions                                                                | Maximum Ratings |                  |
|-----------|--------------------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$ | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$                                 | 600             | V                |
| $V_{DGR}$ | $T_J = 25^\circ\text{C to } 150^\circ\text{C}, R_{GS} = 1M\Omega$              | 600             | V                |
| $V_{GSS}$ | Continuous                                                                     | $\pm 20$        | V                |
| $V_{GSM}$ | Transient                                                                      | $\pm 30$        | V                |
| $I_{D25}$ | $T_C = 25^\circ\text{C}$                                                       | 36              | A                |
| $I_{DM}$  | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$                     | 48              | A                |
| $I_A$     | $T_C = 25^\circ\text{C}$                                                       | 8               | A                |
| $E_{AS}$  | $T_C = 25^\circ\text{C}$                                                       | 750             | mJ               |
| $dv/dt$   | $I_S \leq I_{DM}, V_{DD} \leq V_{DSS}, T_J \leq 150^\circ\text{C}$             | 50              | V/ns             |
| $P_D$     | $T_C = 25^\circ\text{C}$                                                       | 446             | W                |
| $T_J$     |                                                                                | -55 ... +150    | $^\circ\text{C}$ |
| $T_{JM}$  |                                                                                | 150             | $^\circ\text{C}$ |
| $T_{stg}$ |                                                                                | -55 ... +150    | $^\circ\text{C}$ |
| $T_L$     | Maximum Lead Temperature for Soldering<br>1.6 mm (0.062 in.) from Case for 10s | 300             | $^\circ\text{C}$ |
| $M_d$     | Mounting Torque                                                                | 1.13 / 10       | Nm/lb.in         |
| Weight    |                                                                                | 3               | g                |

### Features

- International Standard Package
- Low  $R_{DS(on)}$  and  $Q_G$
- Avalanche Rated
- Low Package Inductance

### Advantages

- High Power Density
- Easy to Mount
- Space Savings

### Applications

- Switch-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- PFC Circuits
- AC and DC Motor Drives
- Robotics and Servo Controls

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                          |
|--------------|-----------------------------------------------------------------------------|-----------------------|------|--------------------------|
|              |                                                                             | Min.                  | Typ. | Max.                     |
| $BV_{DSS}$   | $V_{GS} = 0V, I_D = 1mA$                                                    | 600                   |      | V                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 2.5mA$                                              | 3.5                   |      | 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>$T_J = 125^\circ\text{C}$                |                       |      | 25 $\mu\text{A}$<br>1 mA |
| $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 0.5 \cdot I_{D25}$ , Note 1                            |                       |      | 90 m $\Omega$            |

| Symbol                              | Test Conditions<br>(T <sub>J</sub> = 25°C, Unless Otherwise Specified)                                                                                                           | Characteristic Values                                            |      |           |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|------|-----------|
|                                     |                                                                                                                                                                                  | Min.                                                             | Typ. | Max       |
| <b>g<sub>fs</sub></b>               | V <sub>DS</sub> = 10V, I <sub>D</sub> = 0.5 • I <sub>D25</sub> , Note 1                                                                                                          | 16                                                               | 26   | S         |
| <b>R<sub>Gi</sub></b>               | Gate Input Resistance                                                                                                                                                            |                                                                  | 2.1  | Ω         |
| <b>C<sub>iss</sub></b>              | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1MHz                                                                                                                            |                                                                  | 2030 | pF        |
| <b>C<sub>oss</sub></b>              |                                                                                                                                                                                  |                                                                  | 3050 | pF        |
| <b>C<sub>rss</sub></b>              |                                                                                                                                                                                  |                                                                  | 3.6  | pF        |
| <b>Effective Output Capacitance</b> |                                                                                                                                                                                  |                                                                  |      |           |
| <b>C<sub>o(er)</sub></b>            | Energy related                                                                                                                                                                   | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 0.8 • V <sub>DSS</sub> | 110  | pF        |
| <b>C<sub>o(tr)</sub></b>            | Time related                                                                                                                                                                     |                                                                  | 510  | pF        |
| <b>t<sub>d(on)</sub></b>            | <b>Resistive Switching Times</b><br>V <sub>GS</sub> = 10V, V <sub>DS</sub> = 0.5 • V <sub>DSS</sub> , I <sub>D</sub> = 0.5 • I <sub>D25</sub><br>R <sub>G</sub> = 10Ω (External) |                                                                  | 23   | ns        |
| <b>t<sub>r</sub></b>                |                                                                                                                                                                                  |                                                                  | 8    | ns        |
| <b>t<sub>d(off)</sub></b>           |                                                                                                                                                                                  |                                                                  | 45   | ns        |
| <b>t<sub>f</sub></b>                |                                                                                                                                                                                  |                                                                  | 4    | ns        |
| <b>Q<sub>g(on)</sub></b>            | V <sub>GS</sub> = 10V, V <sub>DS</sub> = 0.5 • V <sub>DSS</sub> , I <sub>D</sub> = 0.5 • I <sub>D25</sub>                                                                        |                                                                  | 29   | nC        |
| <b>Q<sub>gs</sub></b>               |                                                                                                                                                                                  |                                                                  | 10   | nC        |
| <b>Q<sub>gd</sub></b>               |                                                                                                                                                                                  |                                                                  | 10   | nC        |
| <b>R<sub>thJC</sub></b>             |                                                                                                                                                                                  |                                                                  |      | 0.28 °C/W |
| <b>R<sub>thCS</sub></b>             |                                                                                                                                                                                  |                                                                  | 0.50 | °C/W      |

### Source-Drain Diode

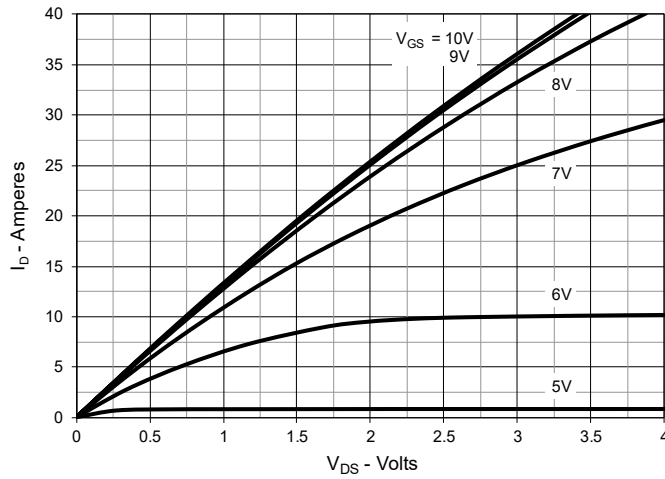
| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)    | Characteristic Values |      |               |
|----------|--------------------------------------------------------------------------------|-----------------------|------|---------------|
|          |                                                                                | Min.                  | Typ. | Max           |
| $I_S$    | $V_{GS} = 0\text{V}$                                                           |                       |      | 36 A          |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                    |                       |      | 144 A         |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                    |                       |      | 1.4 V         |
| $t_{rr}$ | $I_F = 18\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 180  | ns            |
| $Q_{RM}$ |                                                                                |                       | 1.6  | $\mu\text{C}$ |
| $I_{RM}$ |                                                                                |                       | 18.0 | A             |

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

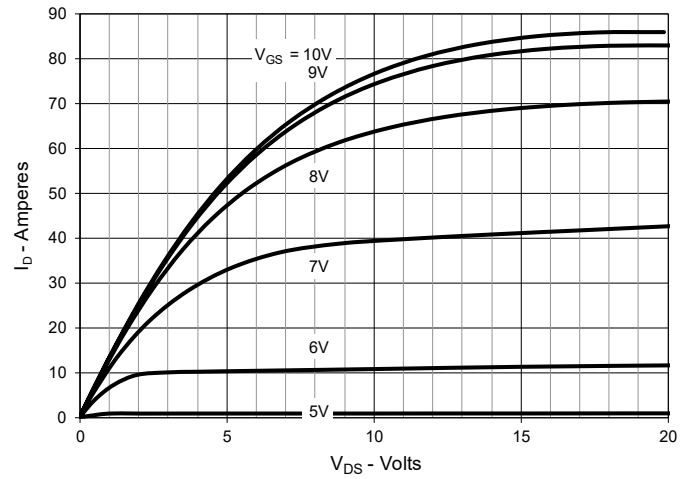
Littelfuse reserves the right to change limits, test conditions and dimensions.

|                                               |           |           |           |           |             |             |             |             |             |             |
|-----------------------------------------------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|
| IXYS MOSFETs and IGBTs are covered            | 4,835,592 | 4,931,844 | 5,049,961 | 5,237,481 | 6,162,665   | 6,404,065B1 | 6,683,344   | 6,727,585   | 7,005,734B2 | 7,157,338B2 |
| by one or more of the following U.S. patents: | 4,860,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123B1 | 6,534,343   | 6,710,405B2 | 6,759,692   | 7,063,975B2 |             |
|                                               | 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728B1 | 6,583,505   | 6,710,463   | 6,771,478B2 | 7,071,537   |             |

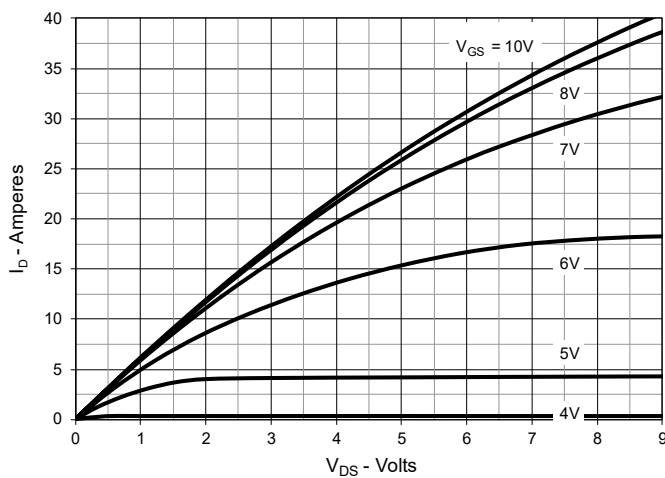
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$**



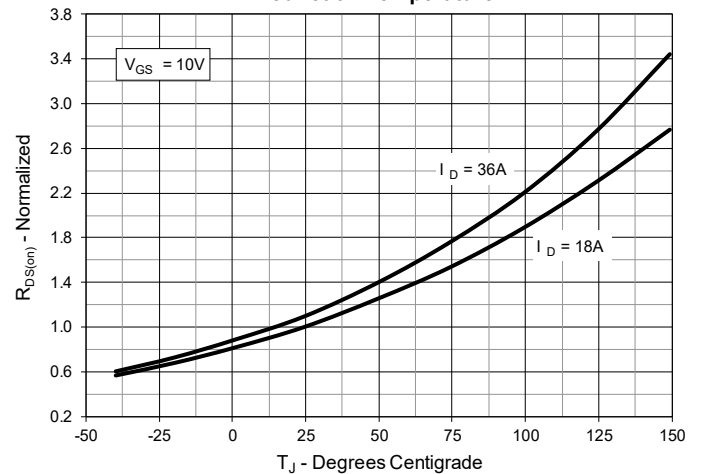
**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$**



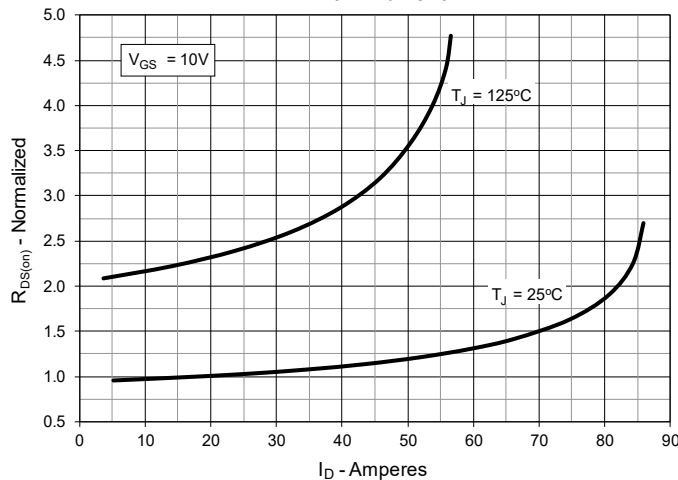
**Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$**



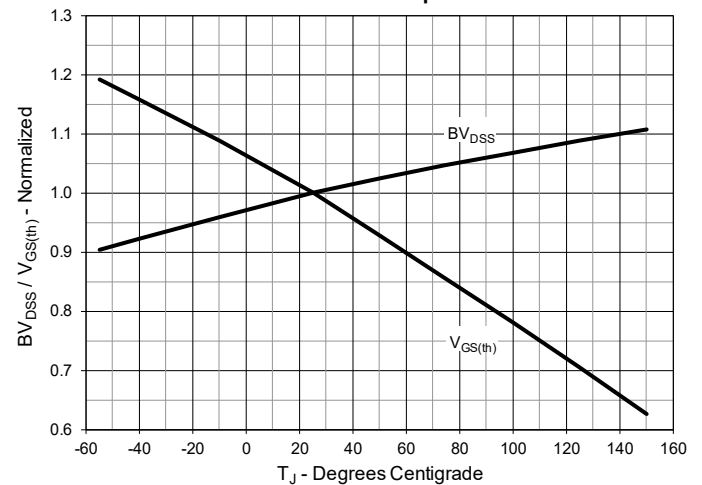
**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 18\text{A}$  Value vs. Junction Temperature**



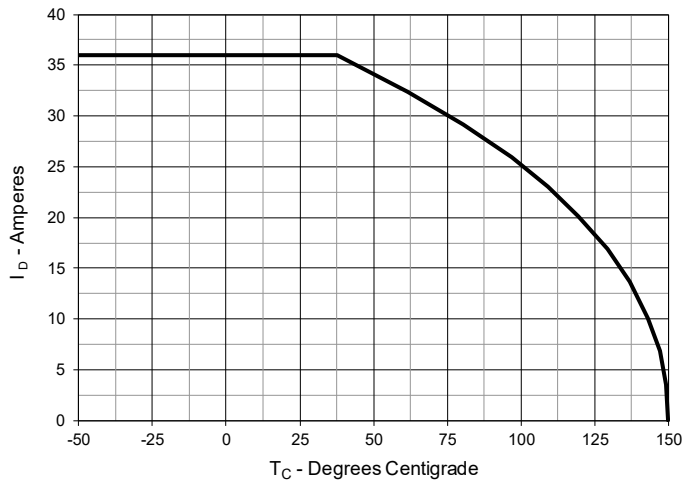
**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 18\text{A}$  Value vs. Drain Current**



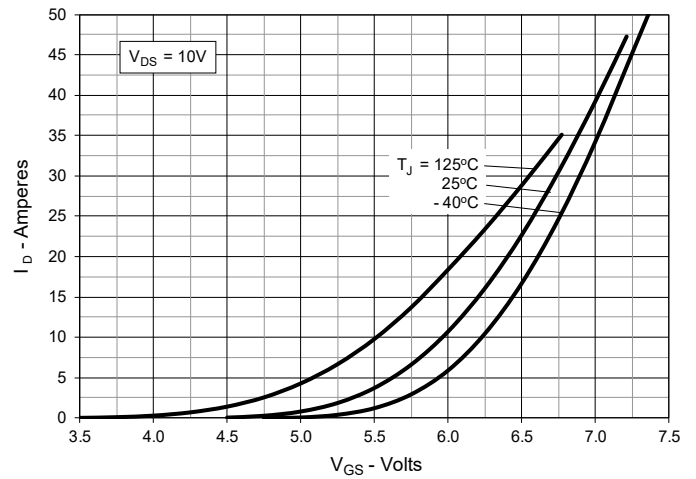
**Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature**



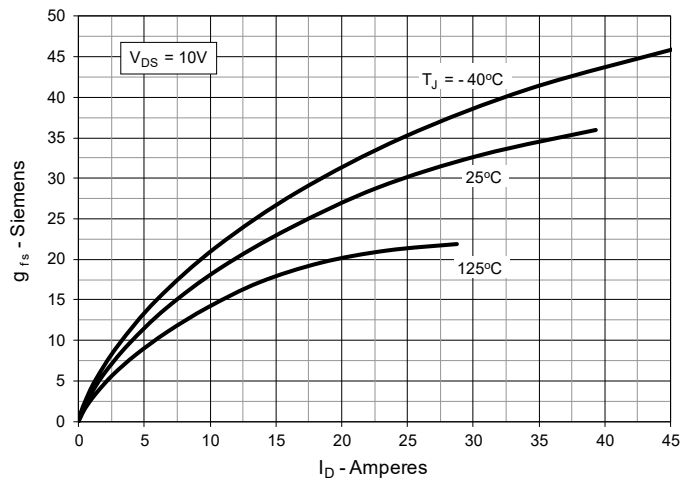
**Fig. 7. Maximum Drain Current vs. Case Temperature**



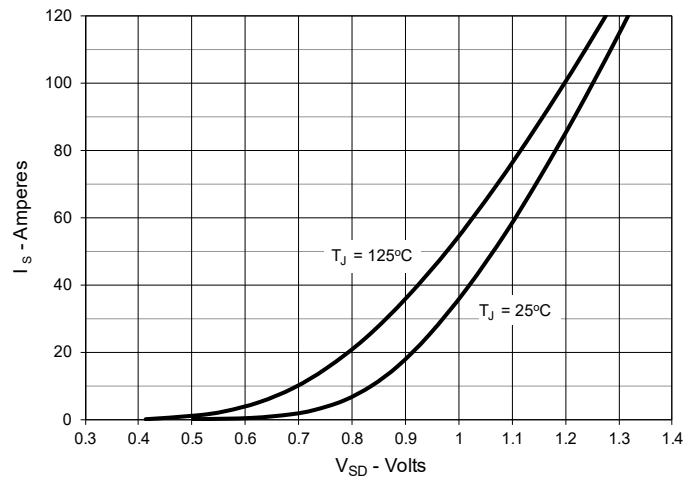
**Fig. 8. Input Admittance**



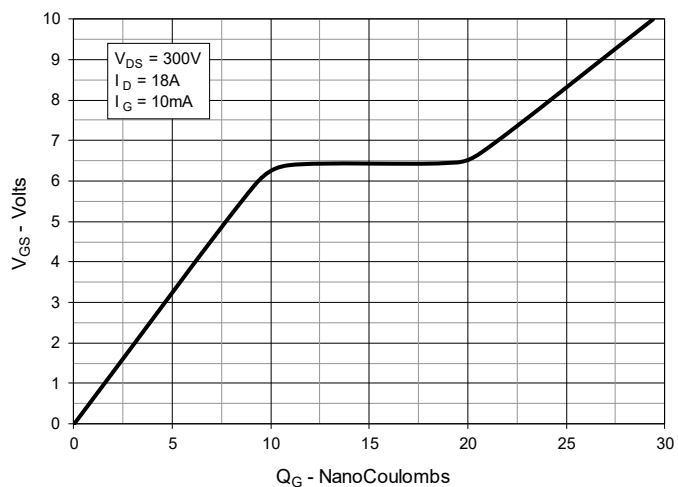
**Fig. 9. Transconductance**



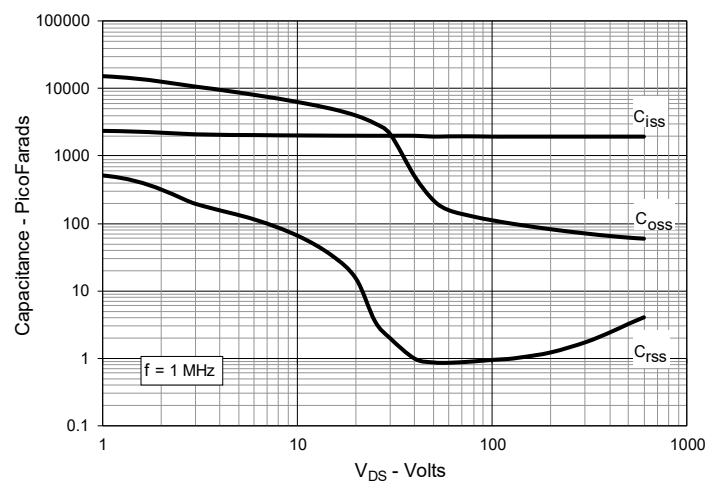
**Fig. 10. Forward Voltage Drop of Intrinsic Diode**



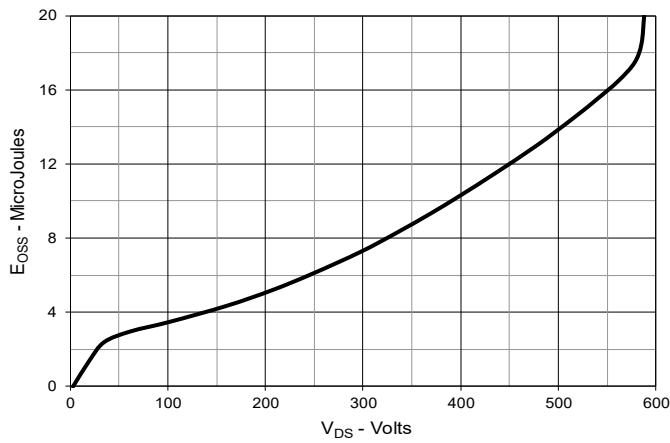
**Fig. 11. Gate Charge**



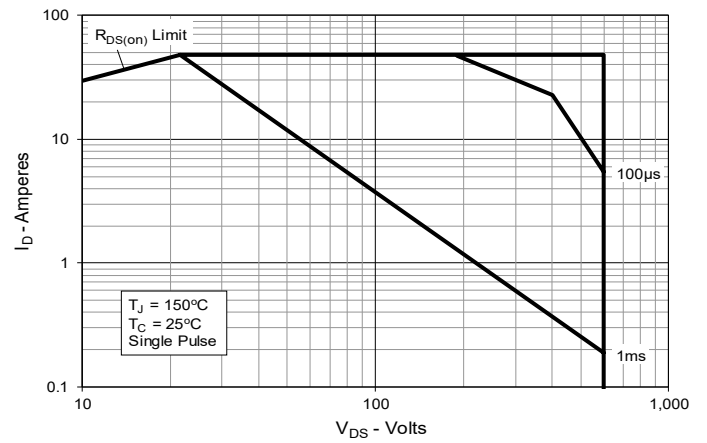
**Fig. 12. Capacitance**



**Fig. 13. Output Capacitance Stored Energy**



**Fig. 14. Forward-Bias Safe Operating Area**



**Fig. 15. Maximum Transient Thermal Impedance**

