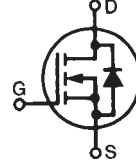


**Polar™ HiPerFET™**  
**Power MOSFET**

**IXFA6N120P**  
**IXFP6N120P**  
**IXFH6N120P**

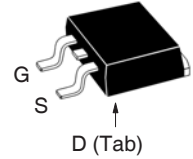
N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode



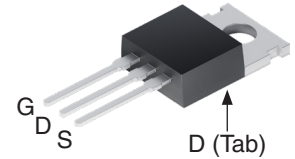
$V_{DSS} = 1200V$   
 $I_{D25} = 6A$   
 $R_{DS(on)} \leq 2.75\Omega$

| Symbol        | Test Conditions  | Maximum Ratings    |            |
|---------------|--|--------------------|------------|
| $V_{DSS}$     | $T_J = 25^\circ C$ to $150^\circ C$                                | 1200               | V          |
| $V_{DGR}$     | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$          | 1200               | V          |
| $V_{GSS}$     | Continuous   | $\pm 30$           | V          |
| $V_{GSM}$     | Transient  | $\pm 40$           | V          |
| $I_{D25}$     | $T_C = 25^\circ C$   | 6                  | A          |
| $I_{DM}$      | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$               | 18                 | A          |
| $I_A$         | $T_C = 25^\circ C$   | 3                  | A          |
| $E_{AS}$      | $T_C = 25^\circ C$   | 300                | mJ         |
| $dv/dt$       | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ C$ | 10                 | V/ns       |
| $P_D$         | $T_C = 25^\circ C$   | 250                | W          |
| $T_J$         |  | -55 ... +150       | $^\circ C$ |
| $T_{JM}$      |  | 150                | $^\circ C$ |
| $T_{stg}$     |  | -55 ... +150       | $^\circ C$ |
| $T_L$         | Maximum Lead Temperature for Soldering                             | 300                | $^\circ C$ |
| $T_{SOLD}$    | 1.6 mm (0.062in.) from Case for 10s                                | 260                | $^\circ C$ |
| $F_C$         | Mounting Force (TO-263)  | 10..65 / 2.2..14.6 | N/lb       |
| $M_d$         | Mounting Torque (TO-247 & TO-220)                                  | 1.13 / 10          | Nm/lb.in   |
| <b>Weight</b> | TO-263   | 2.5                | g          |
|               | TO-220   | 3.0                | g          |
|               | TO-247   | 6.0                | g          |

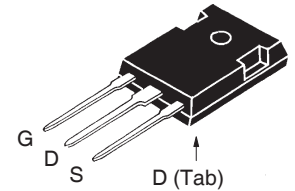
TO-263 AA (IXFA)



TO-220AB (IXFP)



TO-247 (IXFH)



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

**Features**

- International Standard Packages
- Dynamic dv/dt Rating
- Avalanche Rated
- Fast Intrinsic Diode
- Low  $Q_G$  &  $R_{DS(on)}$
- Low Drain-to-Tab Capacitance
- Low Package Inductance

**Advantages**

- Easy to Mount
- Space Savings

**Applications**

- DC-DC Converters
- Battery Chargers
- Switch-Mode and Resonant-Mode Power Supplies
- Uninterrupted Power Supplies
- AC Motor Drives
- High Speed Power Switching Applications

| Symbol       | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |                    |
|--------------|---|-----------------------|------|--------------------|
|              |   | Min.                  | Typ. | Max.               |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 250\mu A$                                      | 1200                  |      | V                  |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 1mA$                                       | 2.5                   |      | 5.0 V              |
| $I_{GSS}$    | $V_{GS} = \pm 30V$ , $V_{DS} = 0V$                                    |                       |      | $\pm 100$ nA       |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 125^\circ C$             |                       |      | 10 $\mu A$<br>1 mA |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                   |                       |      | 2.75 $\Omega$      |

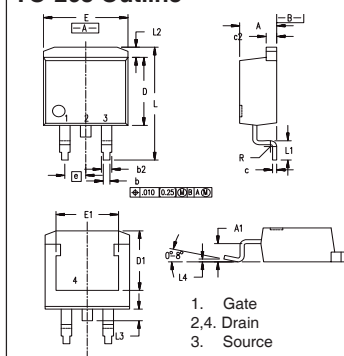
| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)  | Characteristic Values |      |                         |
|--------------|--|-----------------------|------|-------------------------|
|              |  | Min.                  | Typ. | Max                     |
| $g_{fs}$     | $V_{DS} = 20\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1   | 3.0                   | 5.0  | S                       |
| $R_{Gi}$     | Gate Input Resistance  |                       | 1.8  | $\Omega$                |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$   |                       | 2830 | pF                      |
| $C_{oss}$    |  |                       | 150  | pF                      |
| $C_{rss}$    |  |                       | 30   | 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>$R_G = 3\Omega$ (External) |                       | 24   | ns                      |
| $t_r$        |  |                       | 11   | ns                      |
| $t_{d(off)}$ |  |                       | 60   | ns                      |
| $t_f$        |  |                       | 14   | ns                      |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$   |                       | 92   | nC                      |
| $Q_{gs}$     |  |                       | 15   | nC                      |
| $Q_{gd}$     |  |                       | 50   | nC                      |
| $R_{thJC}$   |  |                       |      | 0.50 $^\circ\text{C/W}$ |
| $R_{thCS}$   | TO-220   |                       | 0.50 | $^\circ\text{C/W}$      |
| $R_{thCS}$   | TO-247   |                       | 0.21 | $^\circ\text{C/W}$      |

### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                           | Characteristic Values |      |               |
|----------|---|-----------------------|------|---------------|
|          |   | Min.                  | Typ. | Max           |
| $I_S$    | $V_{GS} = 0\text{V}$  |                       |      | 6 A           |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$   |                       |      | 24 A          |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1   |                       |      | 1.4 V         |
| $t_{rr}$ | $I_F = 3\text{A}$ , $V_{GS} = 0\text{V}$<br>$-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       |      | 300 ns        |
| $I_{RM}$ |   |                       | 7.8  | A             |
| $Q_{RM}$ |   |                       | 1.1  | $\mu\text{C}$ |

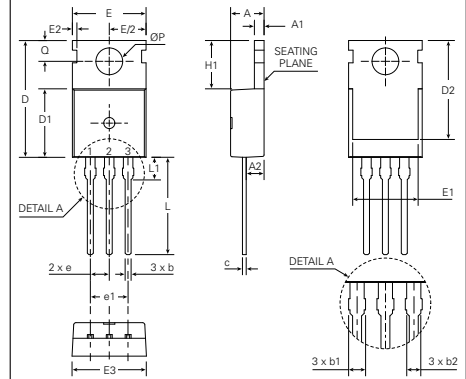
Note 1: Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .

### TO-263 Outline



| Dim. | Millimeter |       | Inches |      |
|------|------------|-------|--------|------|
|      | Min.       | Max.  | Min.   | Max. |
| A    | 4.06       | 4.83  | .160   | .190 |
| b    | 0.51       | 0.99  | .020   | .039 |
| b2   | 1.14       | 1.40  | .045   | .055 |
| c    | 0.40       | 0.74  | .016   | .029 |
| c2   | 1.14       | 1.40  | .045   | .055 |
| D    | 8.64       | 9.65  | .340   | .380 |
| D1   | 8.00       | 8.89  | .280   | .320 |
| E    | 9.65       | 10.41 | .380   | .405 |
| E1   | 6.22       | 8.13  | .270   | .320 |
| e    | 2.54       | BSC   | .100   | BSC  |
| L    | 14.61      | 15.88 | .575   | .625 |
| L1   | 2.29       | 2.79  | .090   | .110 |
| L2   | 1.02       | 1.40  | .040   | .055 |
| L3   | 1.27       | 1.78  | .050   | .070 |
| L4   | 0          | 0.13  | 0      | .005 |

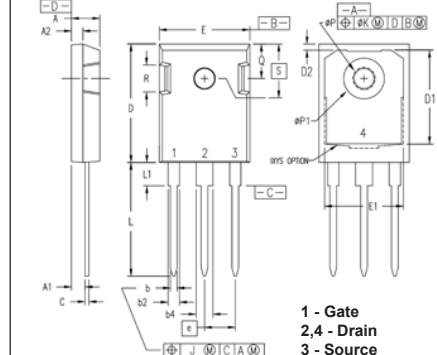
### TO-220 Outline



Pins: 1 - Gate  
2 - Drain  
3 - Source

| Symbol | Inches |         |       | Millimeters |          |       |
|--------|--------|---------|-------|-------------|----------|-------|
|        | Min.   | Typical | Max.  | Min.        | Typical  | Max   |
| A      | 0.169  | 0.177   | 0.185 | 4.30        | 4.50     | 4.70  |
| A1     | 0.049  | 0.051   | 0.055 | 1.25        | 1.30     | 1.40  |
| A2     | 0.087  | 0.094   | 0.102 | 2.20        | 2.40     | 2.60  |
| b      | 0.028  | 0.031   | 0.035 | 0.70        | 0.80     | 0.90  |
| b1     | 0.056  | 0.060   | 0.064 | 1.42        | 1.52     | 1.62  |
| b2     | 0.046  | 0.050   | 0.054 | 1.17        | 1.27     | 1.37  |
| c      | 0.018  | 0.020   | 0.024 | 0.45        | 0.50     | 0.60  |
| D      | 0.610  | 0.618   | 0.626 | 15.50       | 15.70    | 15.90 |
| D1     | 0.354  | 0.362   | 0.370 | 9.00        | 9.20     | 9.40  |
| D2     | 0.516  | 0.524   | 0.531 | 13.10       | 13.30    | 13.50 |
| E      | 0.382  | 0.390   | 0.400 | 9.70        | 9.90     | 10.10 |
| E1     |        | 0.346   |       |             | 8.80     |       |
| E2     |        | 0.024   |       |             | 0.60     |       |
| E3     | 0.386  | 0.394   | 0.402 | 9.80        | 10.00    | 10.20 |
| e      |        | 0.100   |       |             | 2.54 BSC |       |
| e1     |        | 0.200   |       |             | 5.08 BSC |       |
| H1     | 0.248  | 0.256   | 0.264 | 6.30        | 6.50     | 6.70  |
| L      | 0.507  | 0.515   | 0.523 | 12.88       | 13.08    | 13.28 |
| L1     |        | 0.118   |       |             | 3.00     |       |
| OP     | 0.134  | 0.142   | 0.150 | 3.40        | 3.60     | 3.80  |
| Q      | 0.106  | 0.110   | 0.114 | 2.70        | 2.80     | 2.90  |

### TO-247 Outline



1 - Gate  
2,4 - Drain  
3 - Source

| Dim. | Millimeter |          | Inches    |           |
|------|------------|----------|-----------|-----------|
|      | min        | max      | min       | max       |
| A    | 4.70       | 5.30     | 0.185     | 0.209     |
| A1   | 2.21       | 2.59     | 0.087     | 0.102     |
| A2   | 1.50       | 2.49     | 0.059     | 0.098     |
| b    | 0.99       | 1.40     | 0.039     | 0.055     |
| b2   | 1.65       | 2.39     | 0.065     | 0.094     |
| b4   | 2.59       | 3.43     | 0.102     | 0.135     |
| c    | 0.38       | 0.89     | 0.015     | 0.035     |
| D    | 20.79      | 21.45    | 0.819     | 0.845     |
| D1   | 13.07      | -        | 0.515     | -         |
| D2   | 0.51       | 1.35     | 0.020     | 0.053     |
| E    | 15.48      | 16.24    | 0.610     | 0.640     |
| E1   | 13.45      | -        | 0.53      | -         |
| E2   | 4.31       | 5.48     | 0.170     | 0.216     |
| e    | 5.45 BSC   |          | 0.215 BSC |           |
| L    | 19.80      | 20.30    | 0.078     | 0.800     |
| L1   | -          | 4.49     | -         | 0.177     |
| OP   | 3.55       | 3.65     | 0.140     | 0.144     |
| OP1  | -          | 7.39     | -         | 0.290     |
| Q    | 5.38       | 6.19     | 0.212     | 0.244     |
| S    |            | 6.14 BSC |           | 0.242 BSC |

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

|  |           |           |           |           |             |             |             |             |             |             |
|--|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|
| LF 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   | 6,404,065B1 | 6,683,344   | 6,727,585   | 7,005,734B2 | 7,157,338B2 |
|  | 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 @  $T_J = 25^\circ\text{C}$

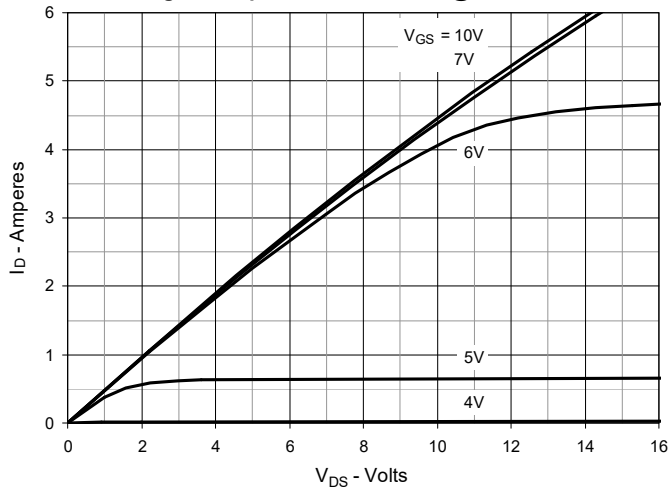


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

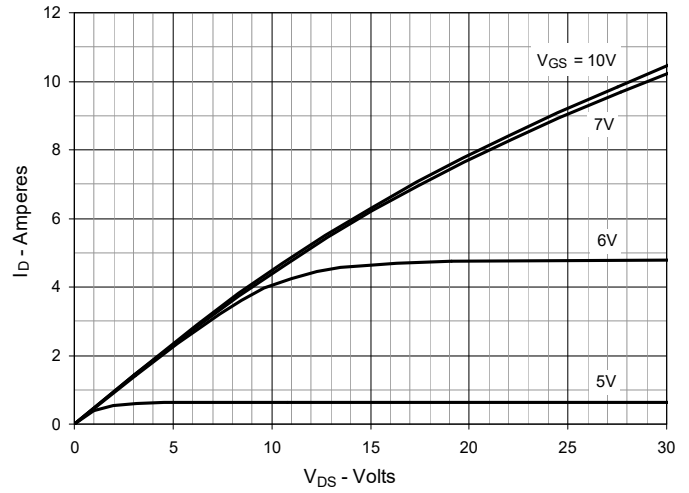


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

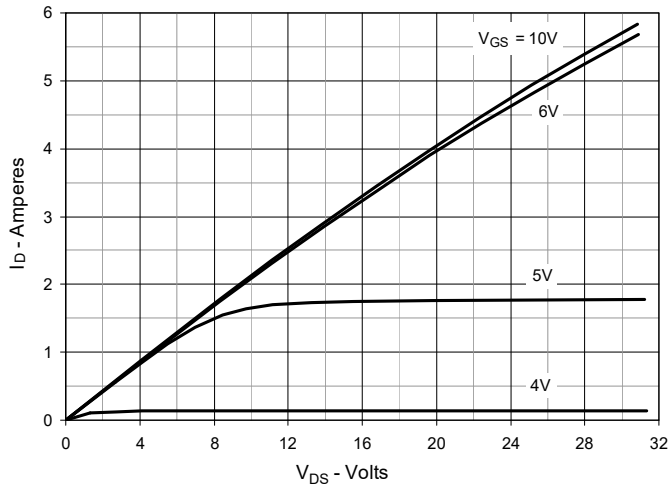


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 3\text{A}$  Value vs. Junction Temperature

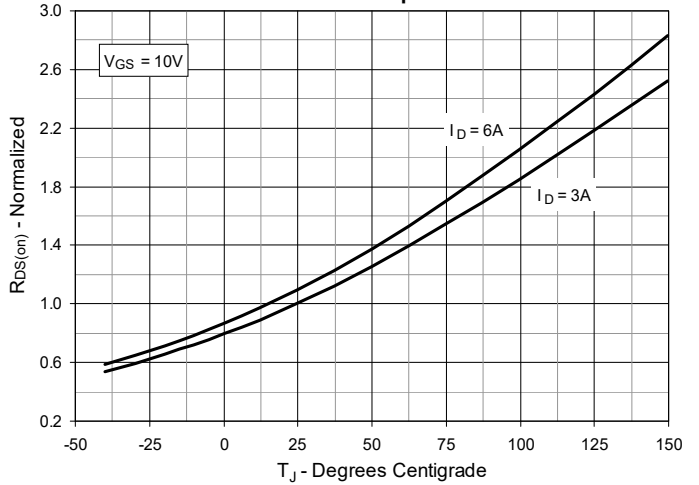


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 3\text{A}$  Value vs. Drain Current

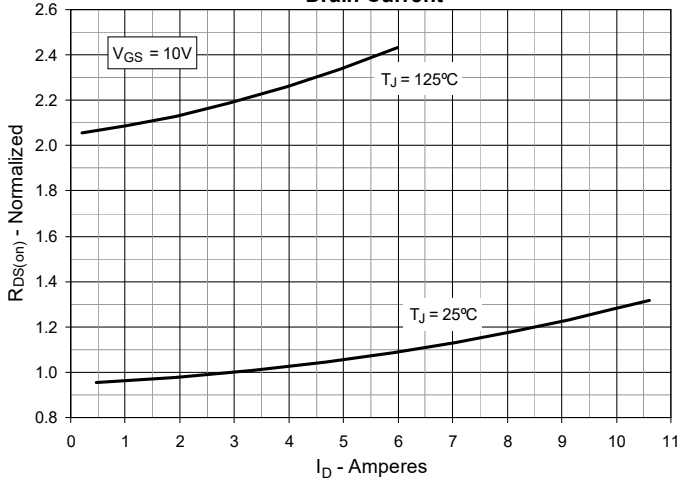
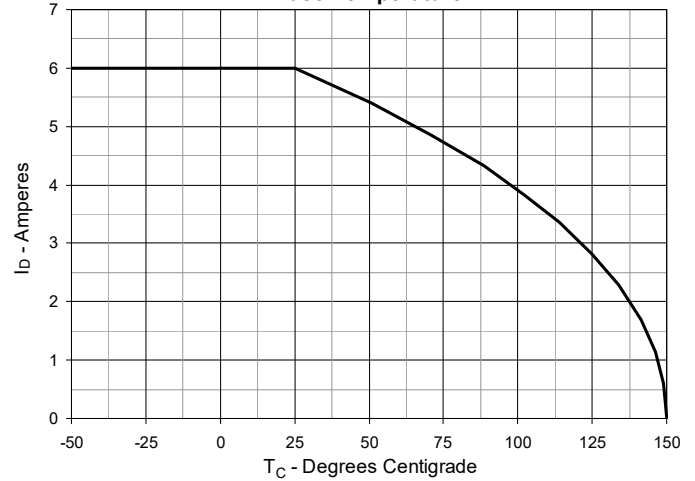
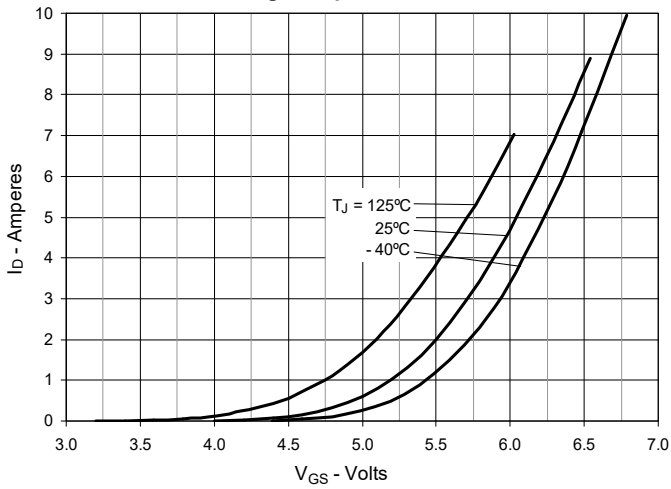


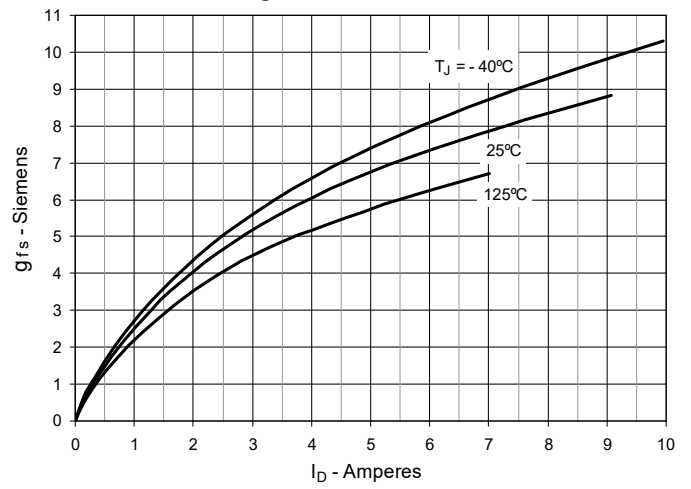
Fig. 6. Maximum Drain Current vs. Case Temperature



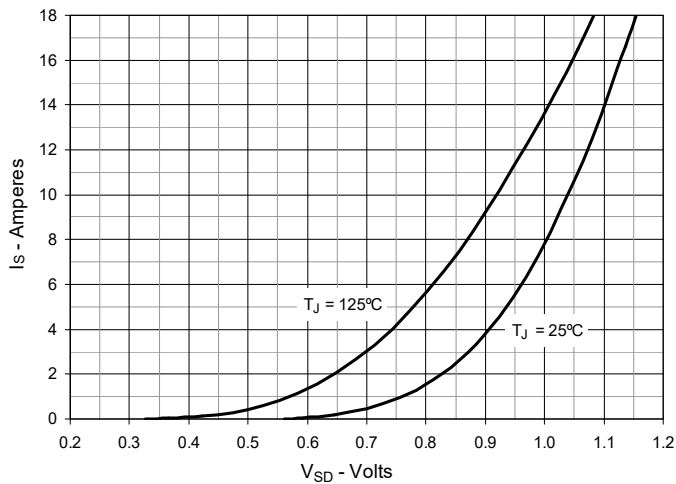
**Fig. 7. Input Admittance**



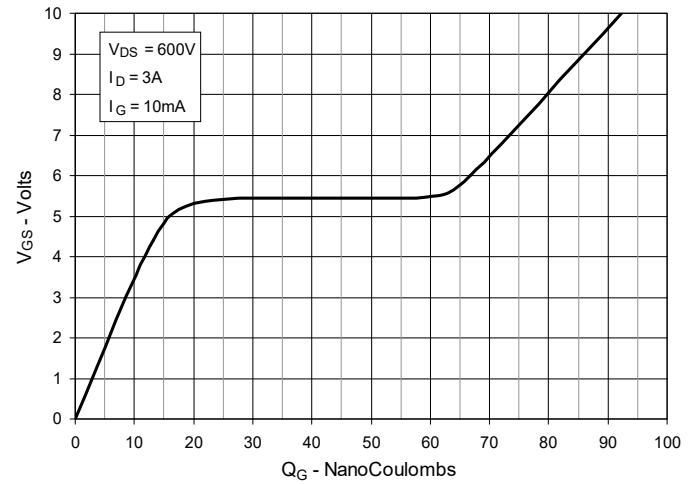
**Fig. 8. Transconductance**



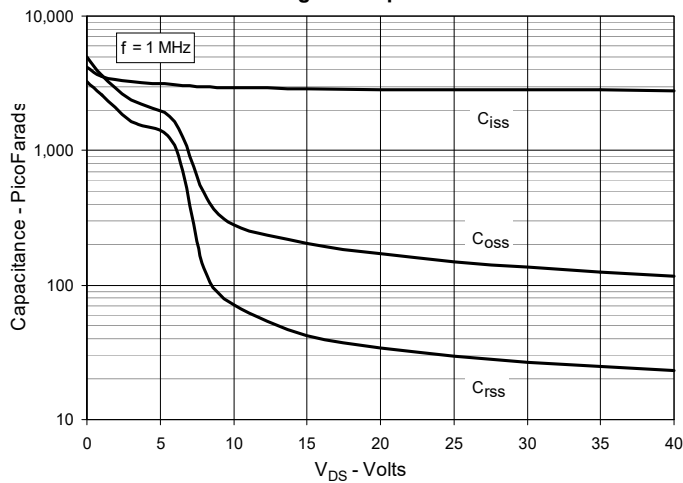
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



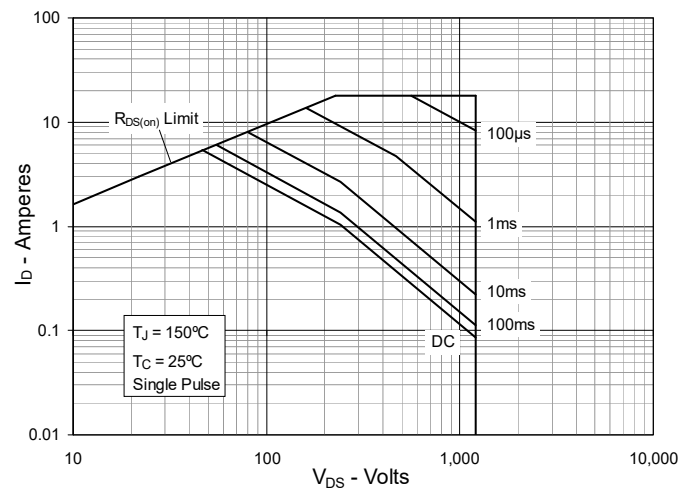
**Fig. 10. Gate Charge**



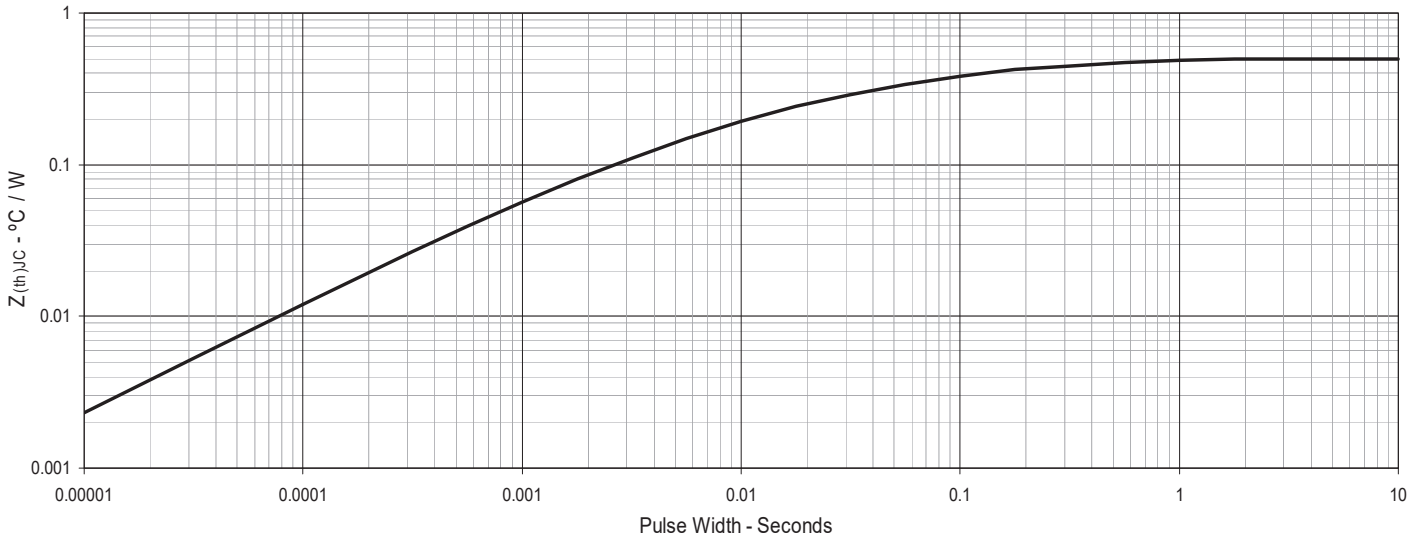
**Fig. 11. Capacitance**



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



**Fig. 13. Maximum Transient Thermal Impedance**



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