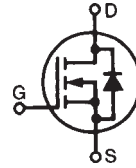


# Polar™ HiPerFET™ Power MOSFET

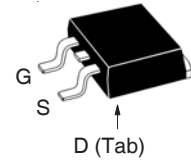
N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode

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

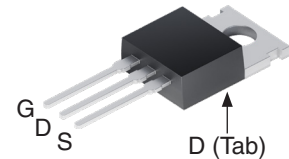


$$\begin{aligned} V_{DSS} &= 1200V \\ I_{D25} &= 6A \\ R_{DS(on)} &\leq 2.75\Omega \end{aligned}$$

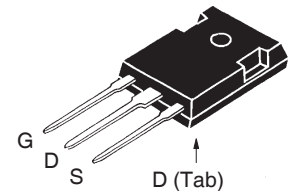
TO-263 AA (IXFA)



TO-220AB (IXFP)



TO-247 (IXFH)



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

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

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

## 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

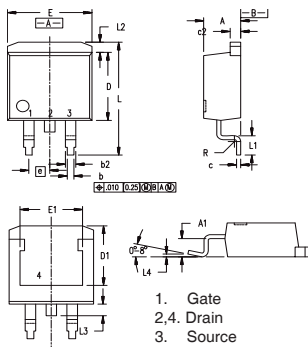
| Symbol                    | Test Conditions                                                                                                                                                                 | Characteristic Values |      |           |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-----------|
|                           | (T <sub>J</sub> = 25°C, Unless Otherwise Specified)                                                                                                                             | Min.                  | Typ. | Max       |
| <b>g<sub>fs</sub></b>     | V <sub>DS</sub> = 20V, I <sub>D</sub> = 0.5 • I <sub>D25</sub> , Note 1                                                                                                         | 3.0                   | 5.0  | S         |
| <b>R<sub>Gi</sub></b>     | Gate Input Resistance                                                                                                                                                           |                       | 1.8  | Ω         |
| <b>C<sub>iss</sub></b>    | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1MHz                                                                                                                           |                       | 2830 | pF        |
| <b>C<sub>oss</sub></b>    |                                                                                                                                                                                 |                       | 150  | pF        |
| <b>C<sub>rss</sub></b>    |                                                                                                                                                                                 |                       | 30   | 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> = 3Ω (External) |                       | 24   | ns        |
| <b>t<sub>r</sub></b>      |                                                                                                                                                                                 |                       | 11   | ns        |
| <b>t<sub>d(off)</sub></b> |                                                                                                                                                                                 |                       | 60   | ns        |
| <b>t<sub>f</sub></b>      |                                                                                                                                                                                 |                       | 14   | 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>                                                                       |                       | 92   | nC        |
| <b>Q<sub>gs</sub></b>     |                                                                                                                                                                                 |                       | 15   | nC        |
| <b>Q<sub>gd</sub></b>     |                                                                                                                                                                                 |                       | 50   | nC        |
| <b>R<sub>thJC</sub></b>   |                                                                                                                                                                                 |                       |      | 0.50 °C/W |
| <b>R<sub>thCS</sub></b>   | TO-220                                                                                                                                                                          |                       | 0.50 | °C/W      |
| <b>R<sub>thCS</sub></b>   | TO-247                                                                                                                                                                          |                       | 0.21 | °C/W      |

### Source-Drain Diode

| Symbol                | Test Conditions                                                                        | Characteristic Values |      |        |
|-----------------------|----------------------------------------------------------------------------------------|-----------------------|------|--------|
|                       | (T <sub>J</sub> = 25°C, Unless Otherwise Specified)                                    | Min.                  | Typ. | Max    |
| <b>I<sub>S</sub></b>  | V <sub>GS</sub> = 0V                                                                   |                       |      | 6 A    |
| <b>I<sub>SM</sub></b> | Repetitive, Pulse Width Limited by T <sub>JM</sub>                                     |                       |      | 24 A   |
| <b>V<sub>SD</sub></b> | I <sub>F</sub> = I <sub>S</sub> , V <sub>GS</sub> = 0V, Note 1                         |                       |      | 1.4 V  |
| <b>t<sub>rr</sub></b> | I <sub>F</sub> = 3A, V <sub>GS</sub> = 0V<br>-di/dt = 100A/μs<br>V <sub>R</sub> = 100V |                       |      | 300 ns |
| <b>I<sub>RM</sub></b> |                                                                                        |                       | 7.8  | A      |
| <b>Q<sub>RM</sub></b> |                                                                                        |                       | 1.1  | μC     |

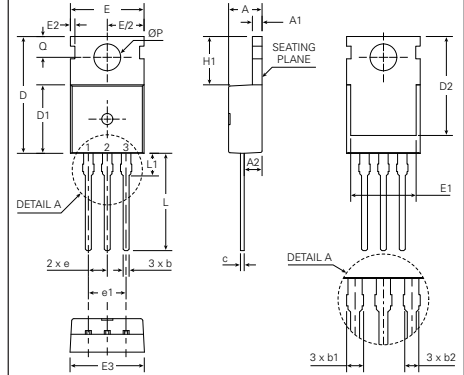
Note 1: Pulse test, t ≤ 300μs, duty cycle, d ≤ 2%.

### 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 |

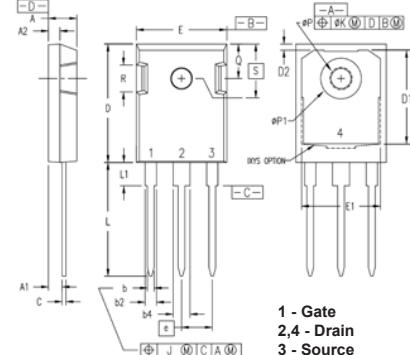
### TO-220 Outline



Pins: 1 - Gate  
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 | 5,162,665   | 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   |             |

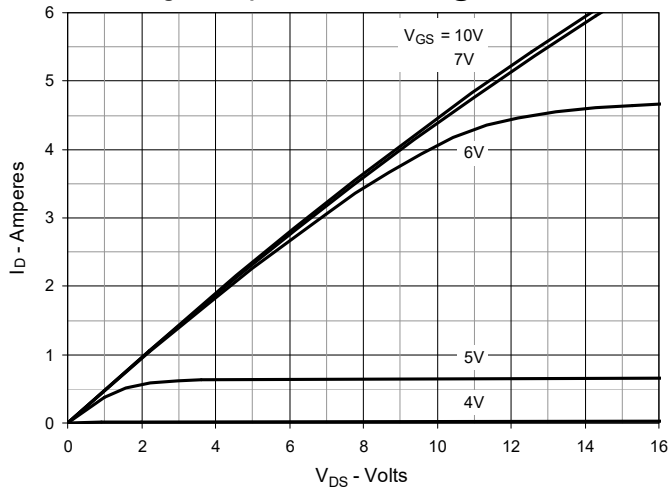
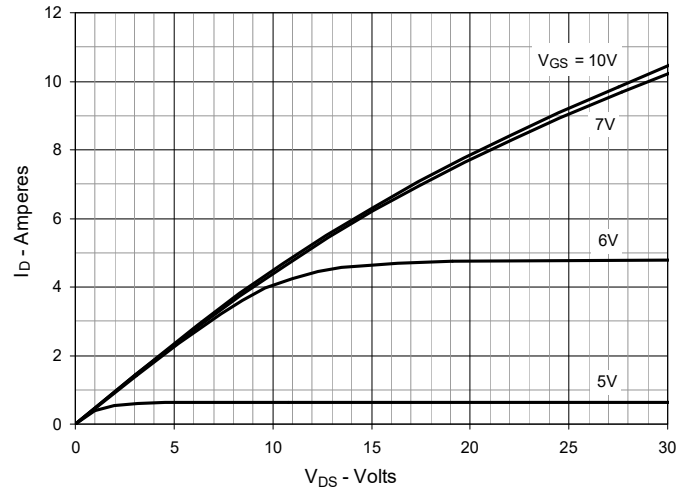
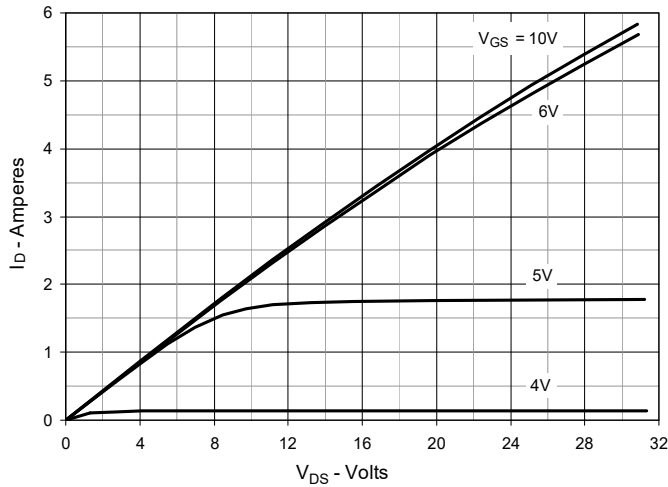
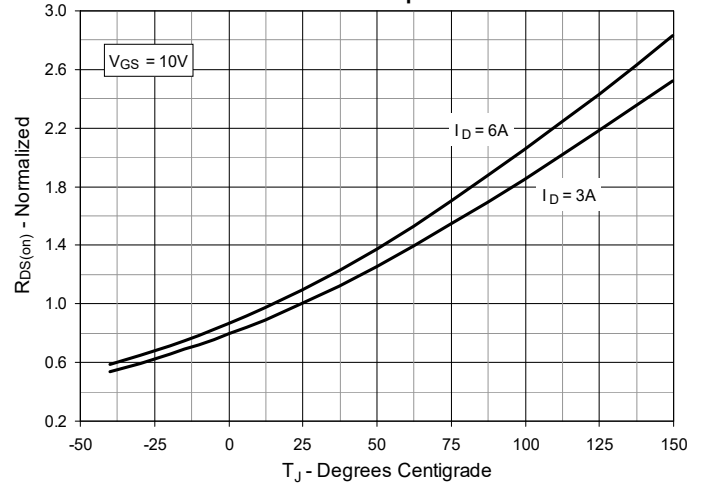
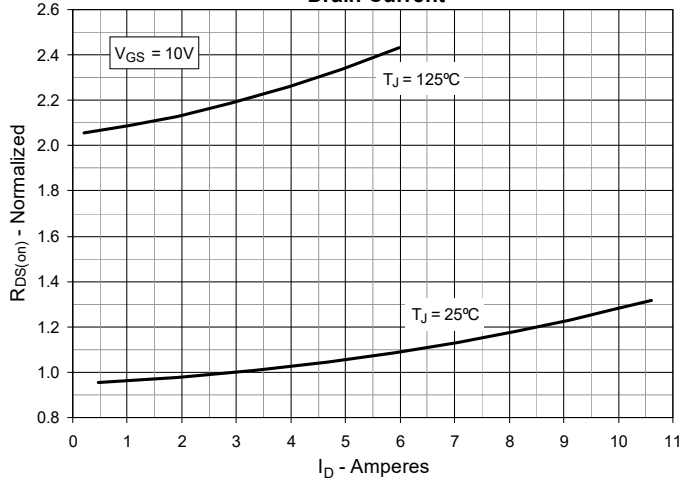
Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$ Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$ Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$ Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 3\text{A}$  Value vs. Junction TemperatureFig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 3\text{A}$  Value vs. Drain Current

Fig. 6. Maximum Drain Current vs. Case Temperature

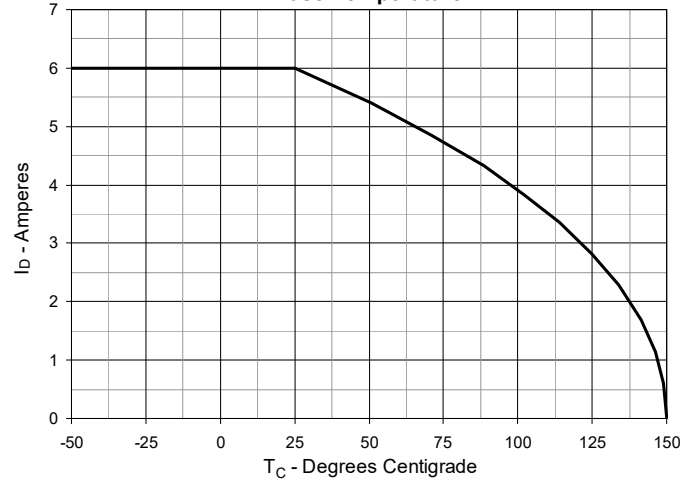


Fig. 7. Input Admittance

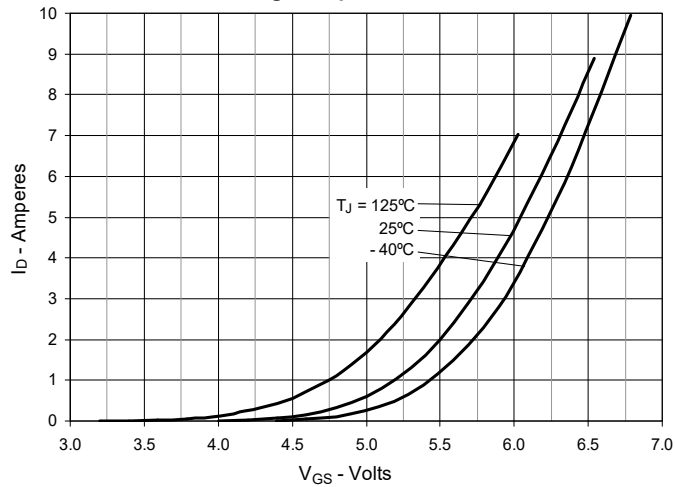


Fig. 8. Transconductance

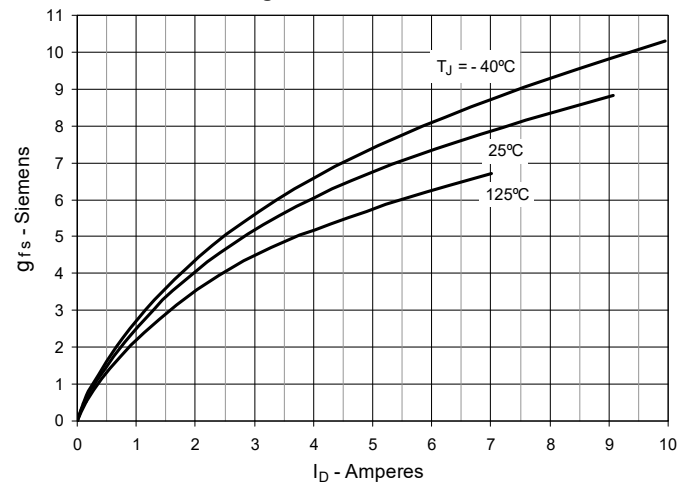


Fig. 9. Forward Voltage Drop of Intrinsic Diode

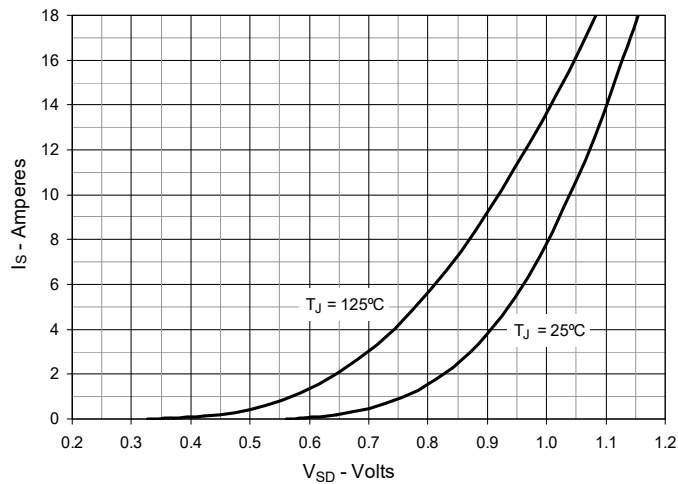


Fig. 10. Gate Charge

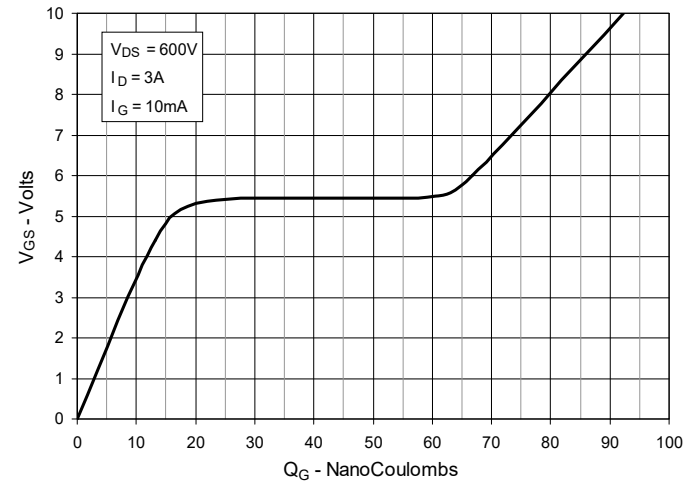


Fig. 11. Capacitance

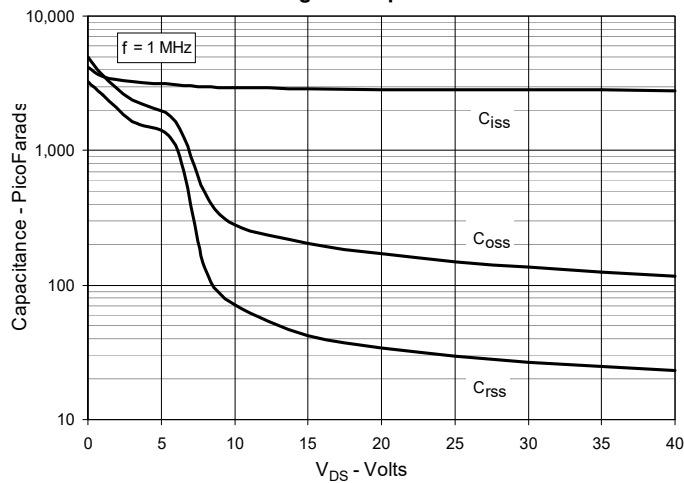


Fig.12. Forward-Bias Safe Operating Area

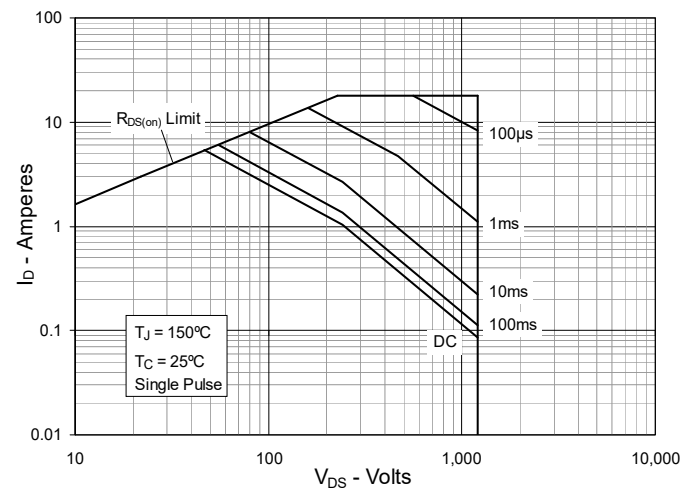
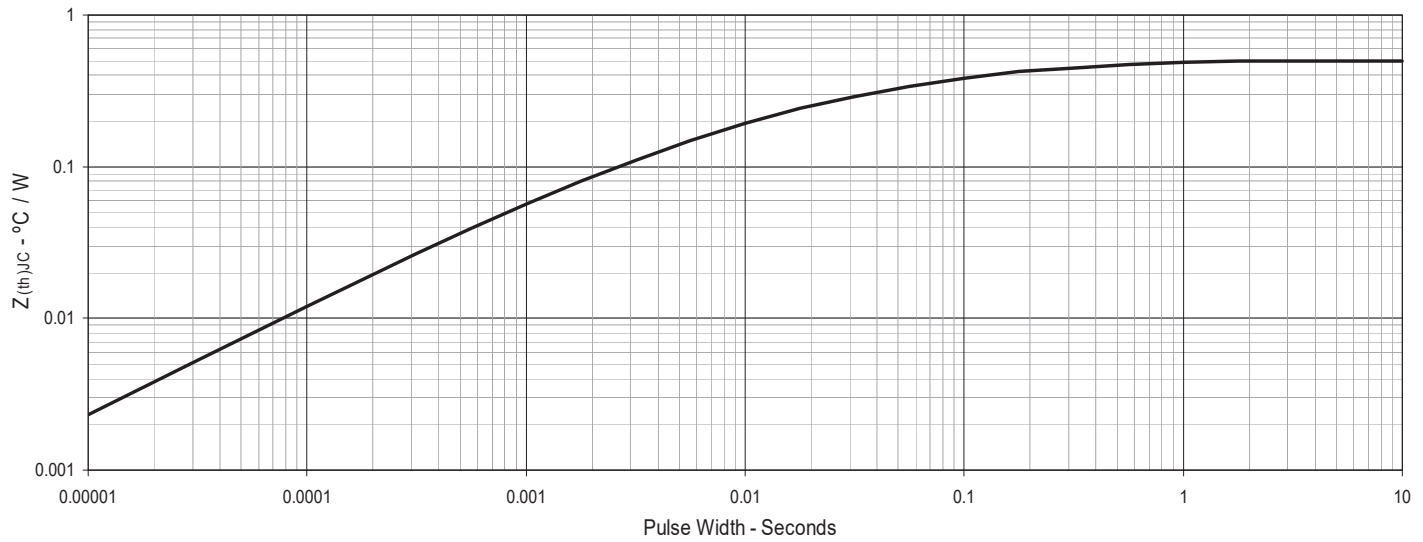


Fig. 13. Maximum Transient Thermal Impedance

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