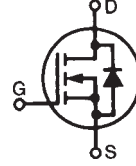


# Polar™ HiPerFET™ Power MOSFET

N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode

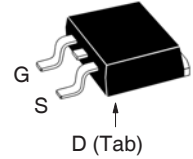
## IXFA6N120P IXFP6N120P IXFH6N120P

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

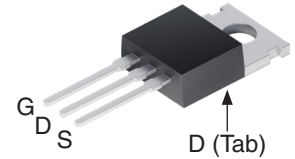


| Symbol        | Test Conditions  | Maximum Ratings    |            |
|---------------|--|--------------------|------------|
| $V_{DSS}$     | $T_J = 25^\circ C$ to $150^\circ C$                                | 1200               | V          |
| $V_{DGR}$     | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$          | 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          |

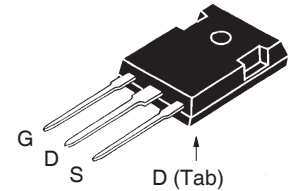
TO-263 AA (IXFA)



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 $\Omega$      |

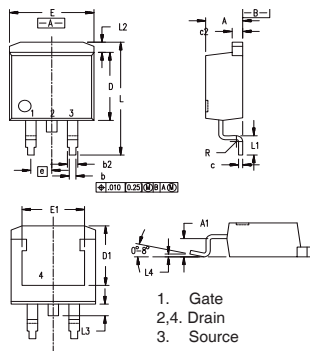
| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)  | Characteristic Values |      |                         |
|--------------|--|-----------------------|------|-------------------------|
|              |  | Min.                  | Typ. | Max                     |
| $g_{fs}$     | $V_{DS} = 20\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , 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,  $d \leq 2\%$ .

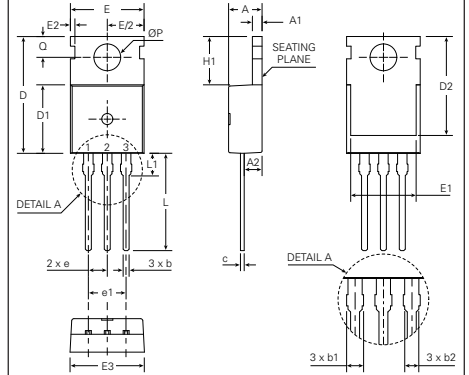
### TO-263 Outline



| 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 |

1. Gate  
2,4. Drain  
3. Source

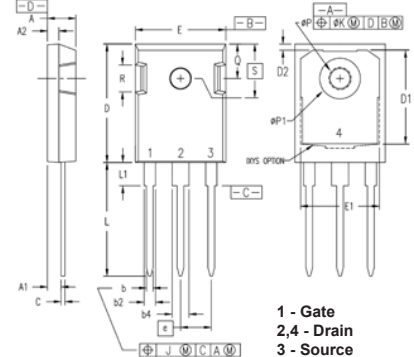
### TO-220 Outline



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 @  $T_J = 25^\circ\text{C}$

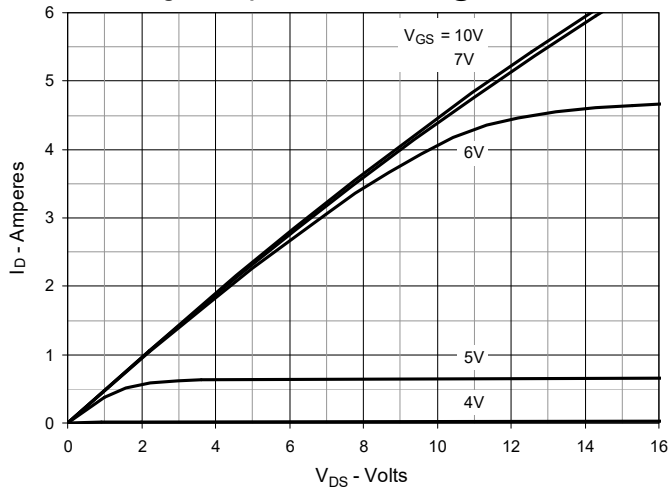


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

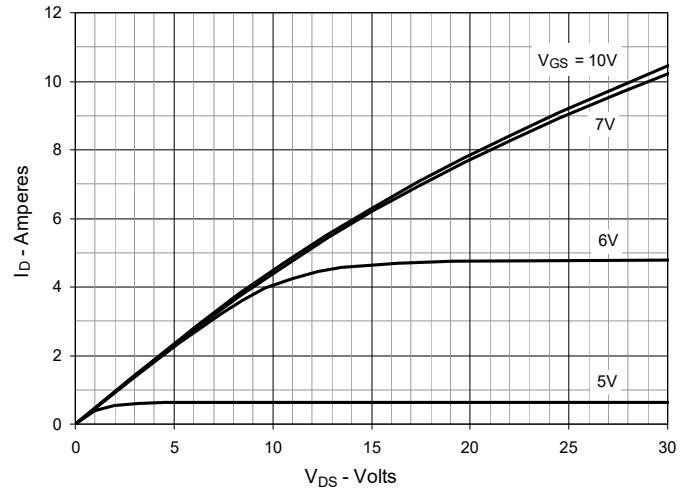


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

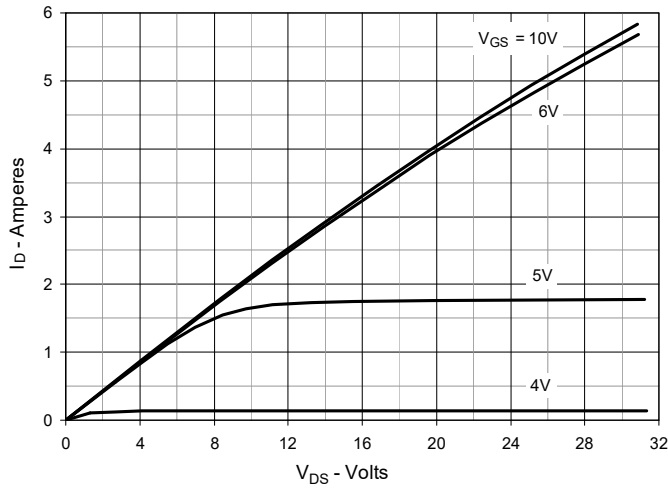


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 3\text{A}$  Value vs. Junction Temperature

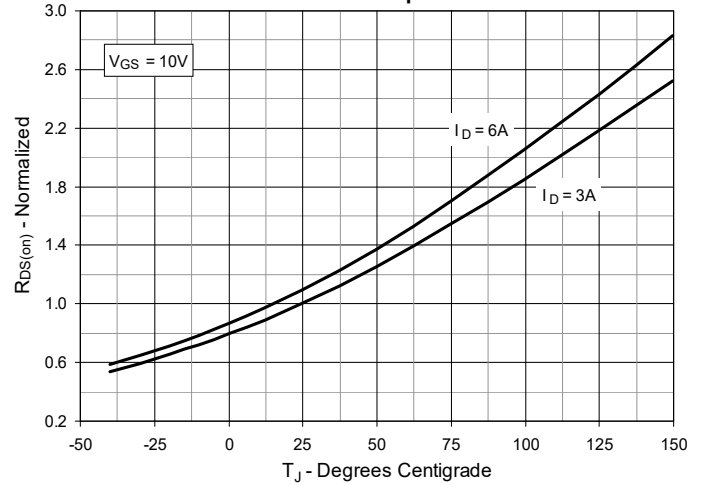


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 3\text{A}$  Value vs. Drain Current

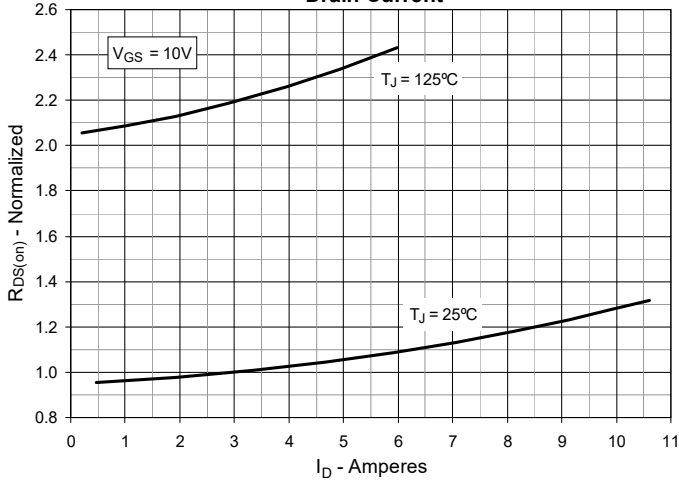


Fig. 6. Maximum Drain Current vs. Case Temperature

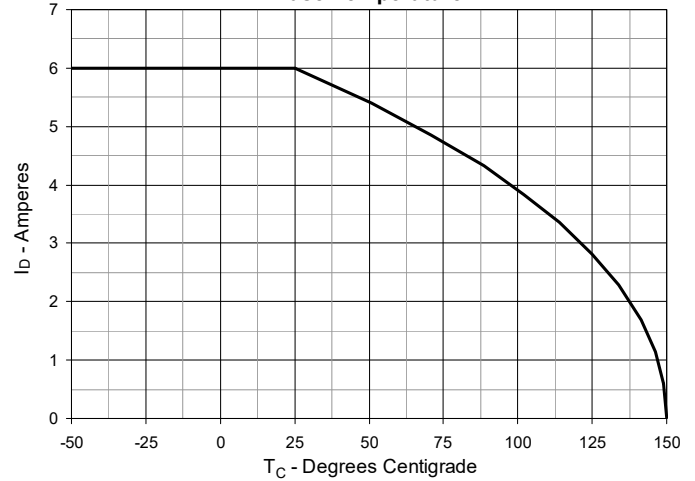


Fig. 7. Input Admittance

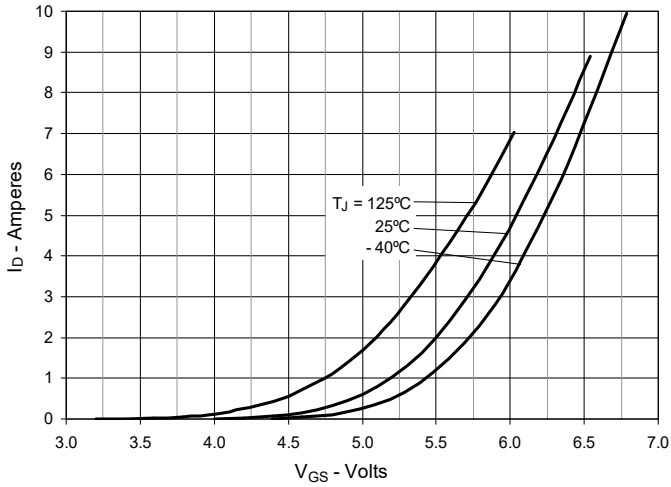


Fig. 8. Transconductance

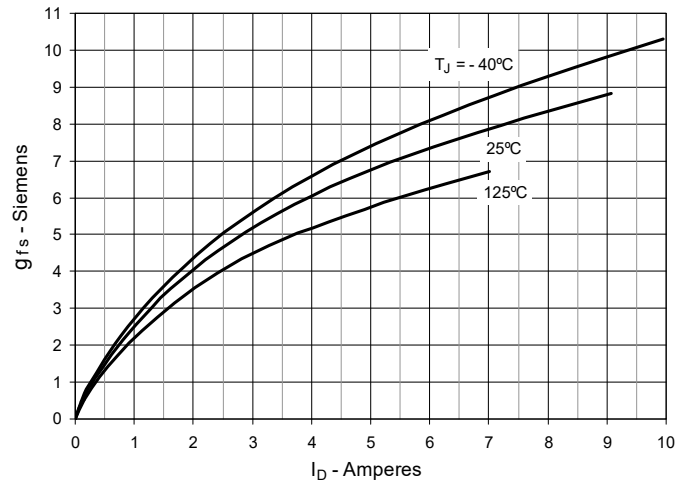


Fig. 9. Forward Voltage Drop of Intrinsic Diode

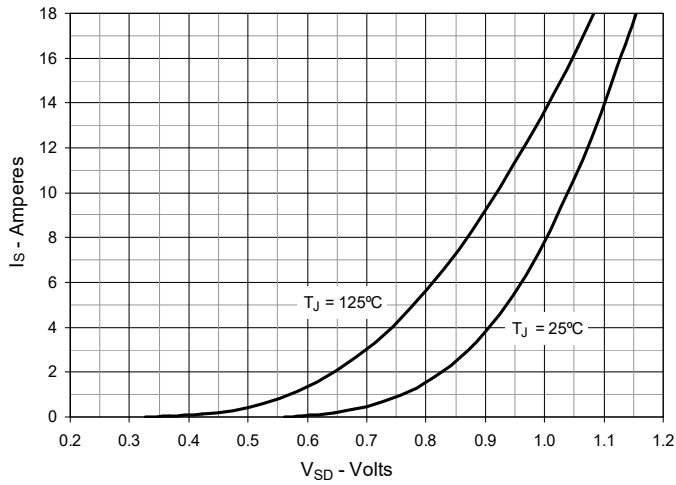


Fig. 10. Gate Charge

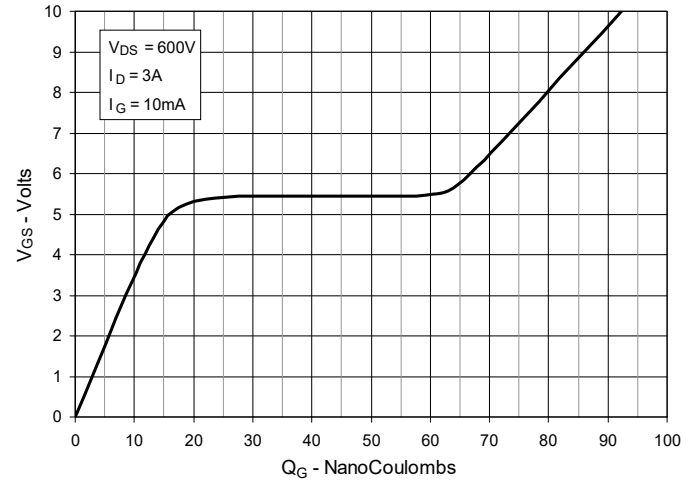


Fig. 11. Capacitance

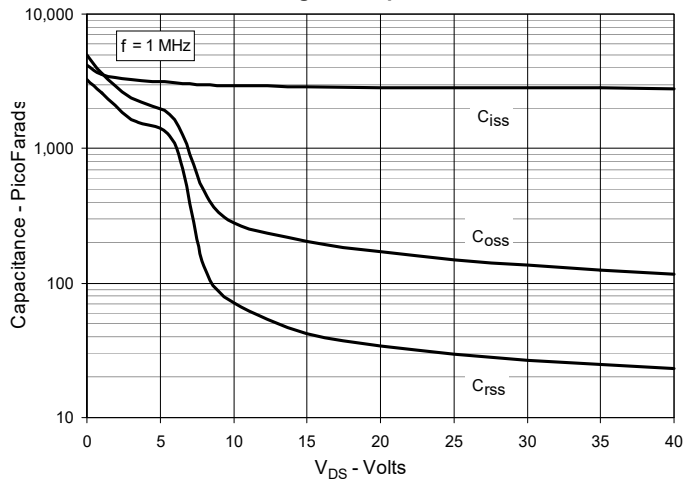
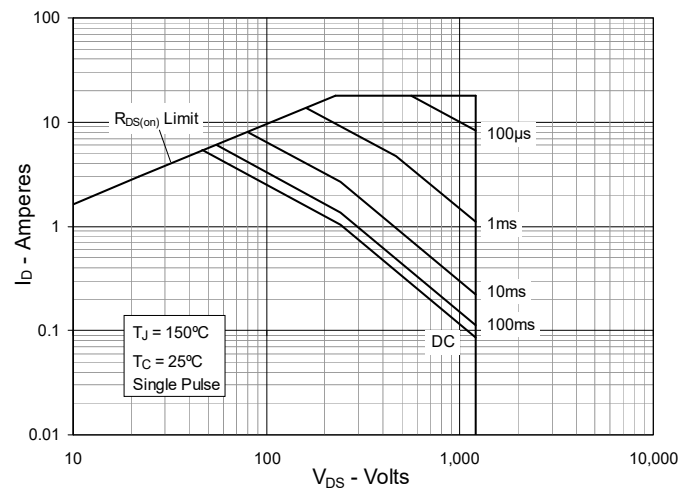
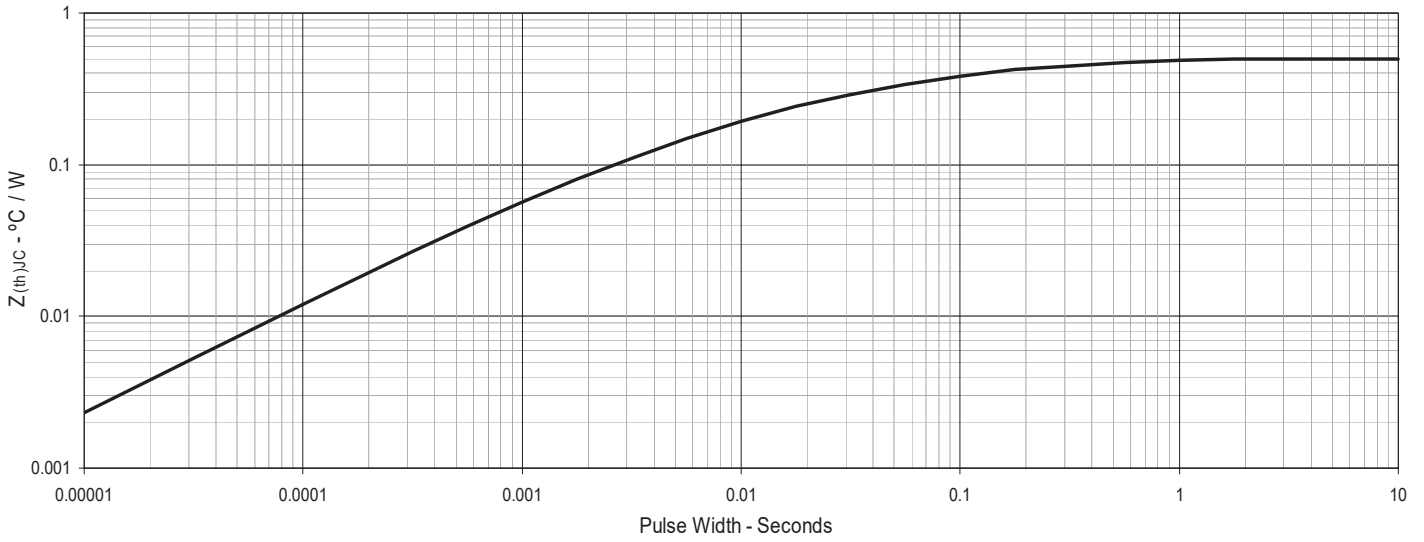


Fig. 12. Forward-Bias Safe Operating Area



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



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