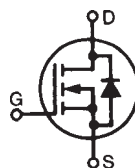


## Trench™ Power MOSFET

**IXTA60N20T**  
**IXTP60N20T**  
**IXTQ60N20T**

**$V_{DSS} = 200V$**   
 **$I_{D25} = 60A$**   
 **$R_{DS(on)} \leq 40m\Omega$**

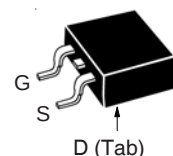
N-Channel Enhancement Mode  
For PDP Drivers  
Avalanche Rated



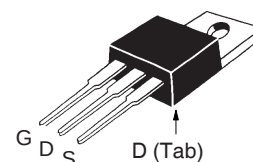
| Symbol        | Test Conditions                                           | Maximum Ratings |            |
|---------------|-----------------------------------------------------------|-----------------|------------|
| $V_{DSS}$     | $T_J = 25^\circ C$ to $175^\circ C$                       | 200             | V          |
| $V_{DGR}$     | $T_J = 25^\circ C$ to $175^\circ C$ , $R_{GS} = 1M\Omega$ | 200             | V          |
| $V_{GSS}$     | Continuous                                                | $\pm 20$        | V          |
| $V_{GSM}$     | Transient                                                 | $\pm 30$        | V          |
| $I_{D25}$     | $T_C = 25^\circ C$                                        | 60              | A          |
| $I_{DM}$      | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$      | 150             | A          |
| $I_A$         | $T_C = 25^\circ C$                                        | 30              | A          |
| $E_{AS}$      | $T_C = 25^\circ C$                                        | 700             | mJ         |
| $P_D$         | $T_C = 25^\circ C$                                        | 500             | W          |
| $T_J$         |                                                           | -55 ... +175    | $^\circ C$ |
| $T_{JM}$      |                                                           | 175             | $^\circ C$ |
| $T_{stg}$     |                                                           | -55 ... +175    | $^\circ C$ |
| $T_L$         | 1.6mm (0.062in.) from Case for 10s                        | 300             | $^\circ C$ |
| $T_{sold}$    | Plastic Body for 10 Seconds                               | 260             | $^\circ C$ |
| $M_d$         | Mounting Torque (TO-220 & TO-3P)                          | 1.13 / 10       | Nm/lb.in.  |
| <b>Weight</b> | TO-263                                                    | 2.5             | g          |
|               | TO-220                                                    | 3.0             | g          |
|               | TO-3P                                                     | 5.5             | g          |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ C$ Unless Otherwise Specified) | Characteristic Values |      |                          |
|--------------|---------------------------------------------------------------------|-----------------------|------|--------------------------|
|              |                                                                     | Min.                  | Typ. | Max.                     |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 250\mu A$                                    | 200                   |      | V                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250\mu A$                                | 3.0                   |      | 5.0 V                    |
| $I_{GSS}$    | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$                                  |                       |      | $\pm 200$ nA             |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$                                  |                       |      | 1 $\mu A$<br>250 $\mu A$ |
|              | $T_J = 150^\circ C$                                                 |                       |      |                          |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                 | 32                    | 40   | m $\Omega$               |

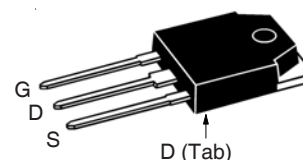
### TO-263 AA (IXTA)



### TO-220AB (IXTP)



### TO-3P (IXTQ)



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

### Features

- High Current Handling Capability
- $175^\circ C$  Operating Temperature
- Avalanche Rated
- Fast Intrinsic Rectifier
- Low  $R_{DS(on)}$

### Advantages

- Easy to Mount
- Space Savings
- High Power Density

### Applications

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

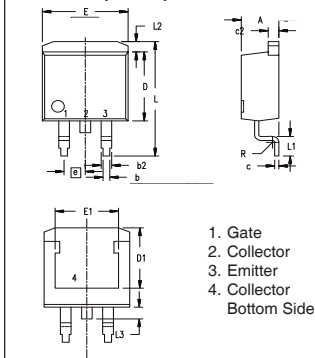
| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                                                         | Characteristic Values |      |                         |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|              |                                                                                                                                                     | Min.                  | Typ. | Max.                    |
| $g_{fs}$     | $V_{DS} = 10\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                                                                                          | 40                    | 62   | S                       |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                    |                       | 4530 | pF                      |
| $C_{oss}$    |                                                                                                                                                     |                       | 490  | pF                      |
| $C_{rss}$    |                                                                                                                                                     |                       | 72   | 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>$R_G = 10\Omega$ (External) |                       | 22   | ns                      |
| $t_r$        |                                                                                                                                                     |                       | 13   | ns                      |
| $t_{d(off)}$ |                                                                                                                                                     |                       | 33   | ns                      |
| $t_f$        |                                                                                                                                                     |                       | 22   | ns                      |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                                                    |                       | 73   | nC                      |
| $Q_{gs}$     |                                                                                                                                                     |                       | 22   | nC                      |
| $Q_{gd}$     |                                                                                                                                                     |                       | 22   | nC                      |
| $R_{thJC}$   |                                                                                                                                                     |                       |      | 0.30 $^\circ\text{C/W}$ |
| $R_{thCS}$   | TO-220                                                                                                                                              |                       | 0.50 | $^\circ\text{C/W}$      |
| $R_{thCS}$   | TO-3P                                                                                                                                               |                       | 0.25 | $^\circ\text{C/W}$      |

### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                  | Characteristic Values |      |       |
|----------|--------------------------------------------------------------------------------------------------------------|-----------------------|------|-------|
|          |                                                                                                              | Min.                  | Typ. | Max.  |
| $I_S$    | $V_{GS} = 0\text{V}$                                                                                         |                       |      | 60 A  |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                                                  |                       |      | 240 A |
| $V_{SD}$ | $I_F = 60\text{A}$ , $V_{GS} = 0\text{V}$ , Note 1                                                           |                       |      | 1.3 V |
| $t_{rr}$ | $I_F = 0.5 \cdot I_{D25}$ , $V_{GS} = 0\text{V}$<br>$-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 85\text{V}$ |                       | 118  | ns    |
| $I_{RM}$ |                                                                                                              |                       | 9.3  | A     |
| $Q_{RM}$ |                                                                                                              |                       | 550  | nC    |

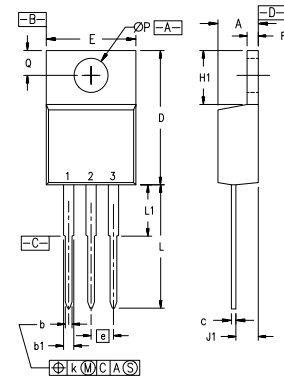
Note 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .

### TO-263 (IXTA) Outline



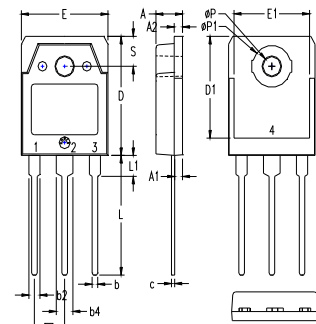
| Dim. | Millimeter |       | Inches |      |
|------|------------|-------|--------|------|
|      | Min.       | Max.  | Min.   | Max. |
| A    | 4.06       | 4.83  | .160   | .190 |
| b    | 0.51       | 0.99  | .020   | .039 |
| b2   | 1.14       | 1.40  | .045   | .055 |
| c    | 0.40       | 0.74  | .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 (IXTP) Outline



| SYM | INCHES |      | MILLIMETERS |       |
|-----|--------|------|-------------|-------|
|     | MIN    | MAX  | MIN         | MAX   |
| A   | .170   | .190 | 4.32        | 4.83  |
| b   | .025   | .040 | 0.64        | 1.02  |
| b1  | .045   | .065 | 1.15        | 1.65  |
| c   | .014   | .022 | 0.35        | 0.56  |
| D   | .580   | .630 | 14.73       | 16.00 |
| E   | .390   | .420 | 9.91        | 10.66 |
| e   | .100   | BSC  | 2.54        | BSC   |
| F   | .045   | .055 | 1.14        | 1.40  |
| H1  | .230   | .270 | 5.85        | 6.85  |
| J1  | .090   | .110 | 2.29        | 2.79  |
| k   | 0      | .015 | 0           | 0.38  |
| L   | .500   | .550 | 12.70       | 13.97 |
| L1  | .110   | .230 | 2.79        | 5.84  |
| ØP  | .139   | .161 | 3.53        | 4.08  |
| Q   | .100   | .125 | 2.54        | 3.18  |

### TO-3P (IXTQ) Outline



| SYM | INCHES |      | MILLIMETERS |       |
|-----|--------|------|-------------|-------|
|     | MIN    | MAX  | MIN         | MAX   |
| A   | .185   | .193 | 4.70        | 4.90  |
| A1  | .051   | .059 | 1.30        | 1.50  |
| A2  | .057   | .065 | 1.45        | 1.65  |
| b   | .035   | .045 | 0.90        | 1.15  |
| b2  | .075   | .087 | 1.90        | 2.20  |
| b4  | .114   | .126 | 2.90        | 3.20  |
| c   | .022   | .031 | 0.55        | 0.80  |
| D   | .780   | .799 | 19.80       | 20.30 |
| D1  | .665   | .677 | 16.90       | 17.20 |
| E   | .610   | .622 | 15.50       | 15.80 |
| E1  | .531   | .539 | 13.50       | 13.70 |
| e   | .215   | BSC  | 5.45        | BSC   |
| L   | .779   | .795 | 19.80       | 20.20 |
| L1  | .134   | .142 | 3.40        | 3.60  |
| ØP  | .126   | .134 | 3.20        | 3.40  |
| ØP1 | .272   | .280 | 6.90        | 7.10  |
| S   | .193   | .201 | 4.90        | 5.10  |

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

|                                                                                  |           |           |           |           |              |              |              |              |              |             |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| IXYS 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    | 6,404,065 B1 | 6,683,344    | 6,727,585    | 7,005,734 B2 | 7,157,338B2 |
|                                                                                  | 4,850,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123 B1 | 6,534,343    | 6,710,405 B2 | 6,759,692    | 7,063,975 B2 |             |
|                                                                                  | 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728 B1 | 6,583,505    | 6,710,463    | 6,771,478 B2 | 7,071,537    |             |

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

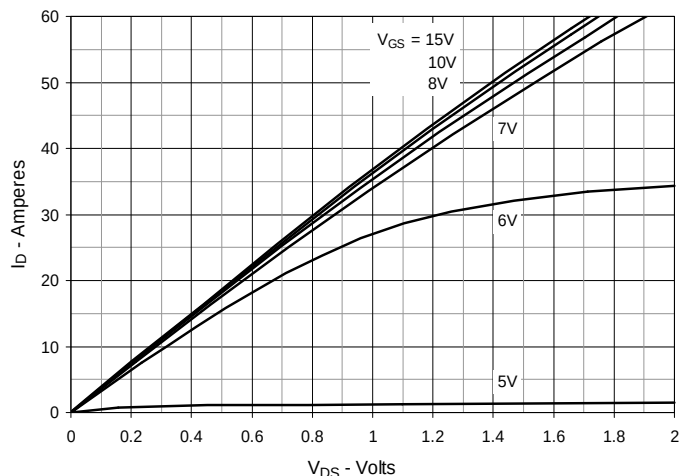


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

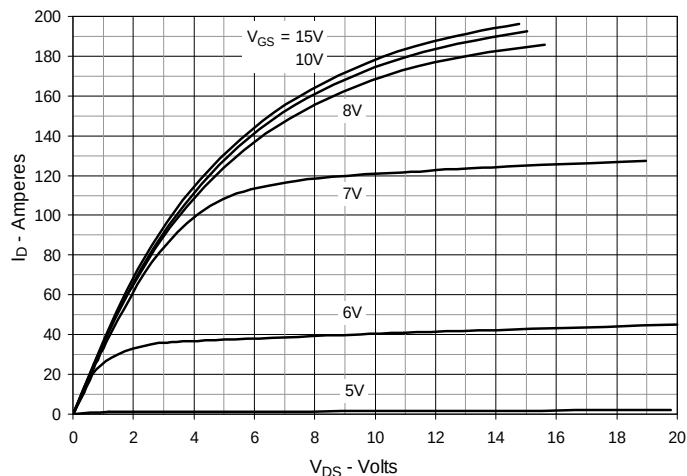


Fig. 3. Output Characteristics @  $T_J = 150^\circ\text{C}$

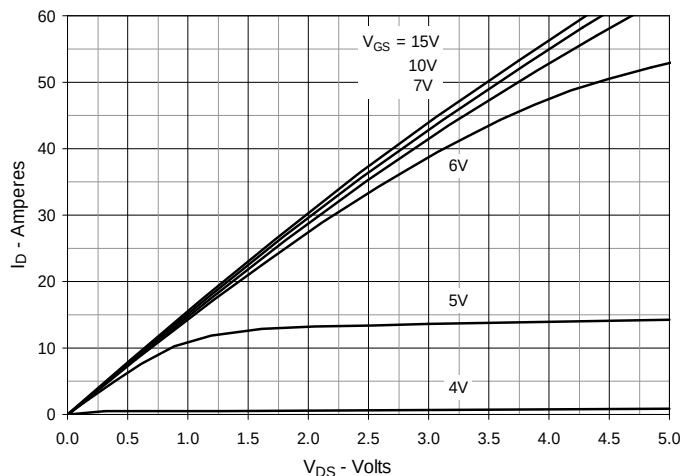


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 30\text{A}$  Value vs. Junction Temperature

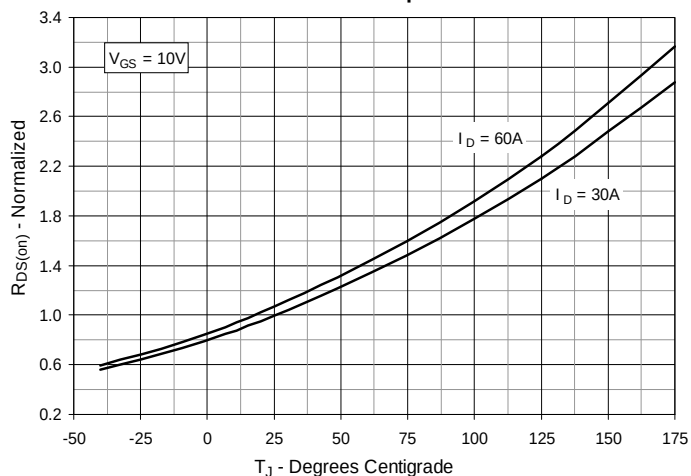


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 30\text{A}$  Value vs. Drain Current

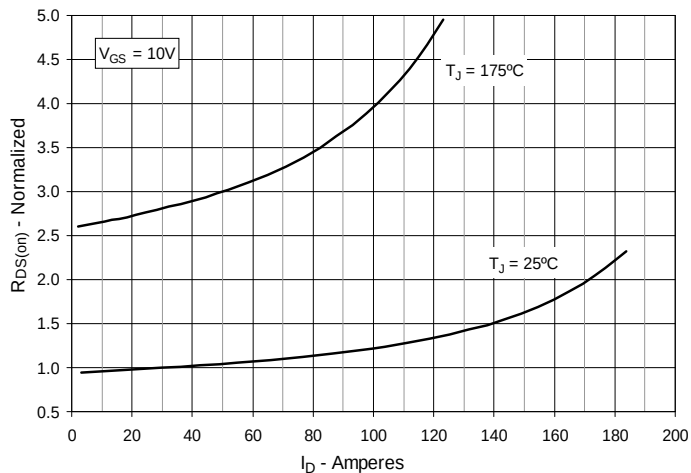


Fig. 6. Maximum Drain Current vs. Case Temperature

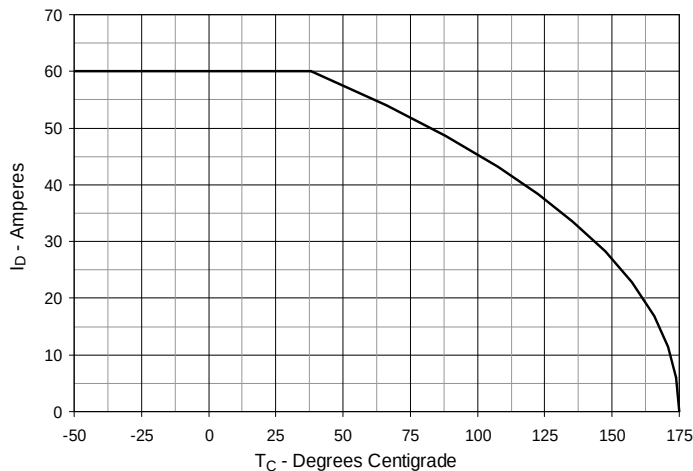


Fig. 7. Input Admittance

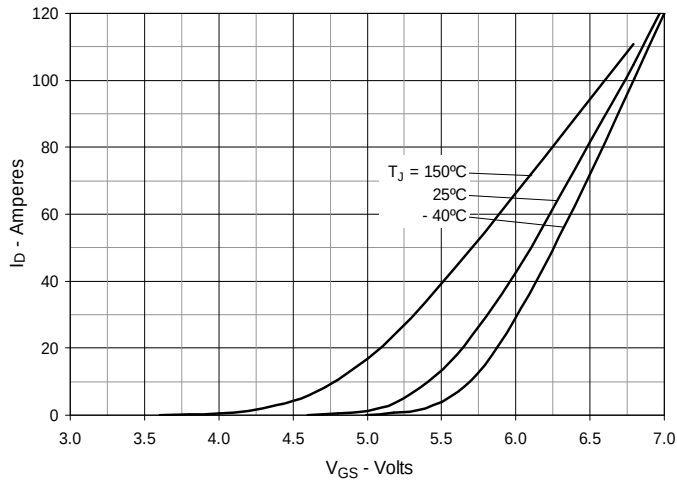


Fig. 8. Transconductance

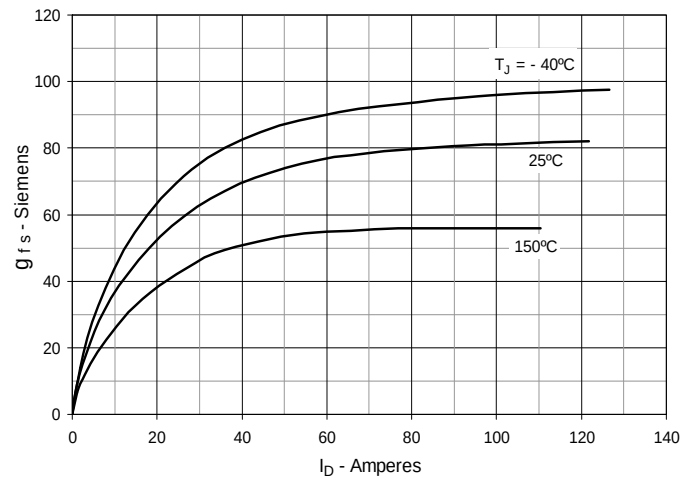


Fig. 9. Forward Voltage Drop of Intrinsic Diode

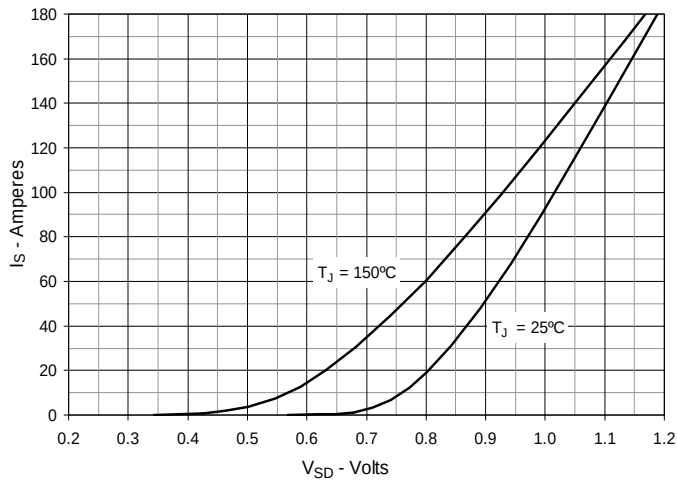


Fig. 10. Gate Charge

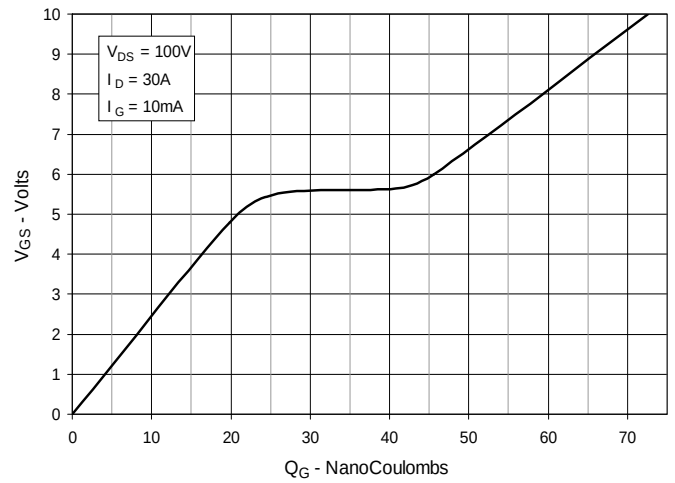


Fig. 11. Capacitance

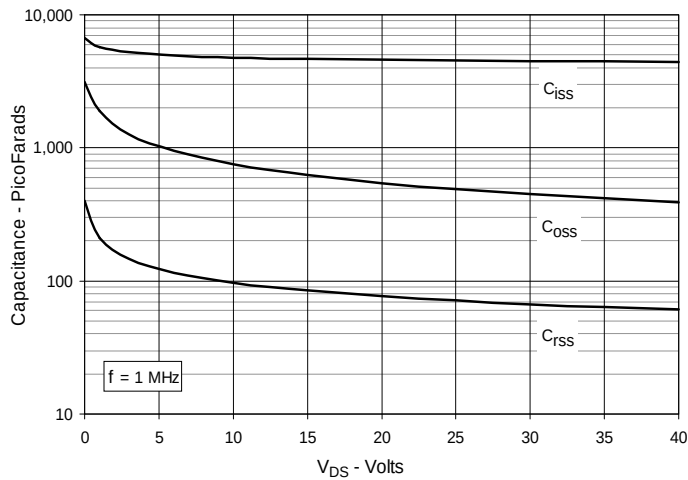
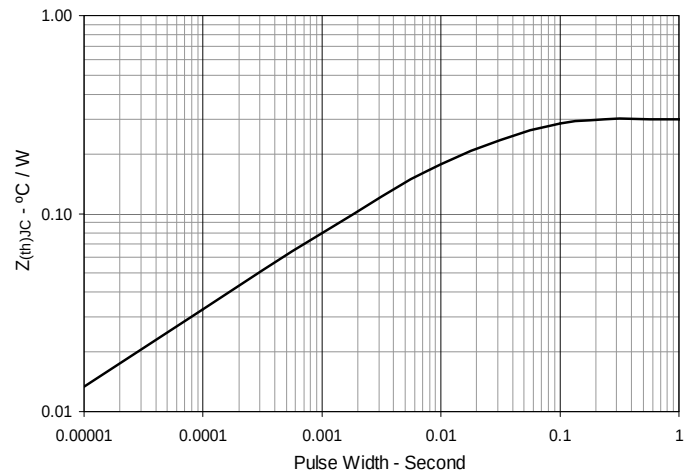


Fig. 12. Maximum Transient Thermal Impedance





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