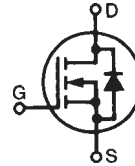


# PolarHV™ Power MOSFET

N-Channel Enhancement Mode  
Avalanche Rated

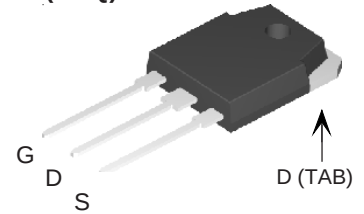
**IXTQ 18N60P**  
**IXTV 18N60P**  
**IXTV 18N60PS**

$V_{DSS} = 600 \text{ V}$   
 $I_{D25} = 18 \text{ A}$   
 $R_{DS(on)} \leq 420 \text{ m}\Omega$

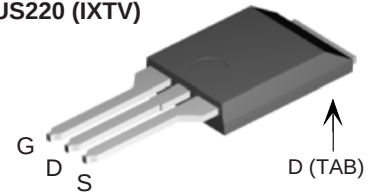


| Symbol     | Test Conditions                                                                                                                         | Maximum Ratings |                  |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$  | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$                                                                                          | 600             | V                |
| $V_{DGR}$  | $T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GS} = 1 \text{ M}\Omega$                                                              | 600             | V                |
| $V_{GS}$   | Continuous                                                                                                                              | $\pm 30$        | V                |
| $V_{GSM}$  | Transient                                                                                                                               | $\pm 40$        | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 18              | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$                                                                              | 54              | A                |
| $I_{AR}$   | $T_C = 25^\circ\text{C}$                                                                                                                | 18              | A                |
| $E_{AR}$   | $T_C = 25^\circ\text{C}$                                                                                                                | 30              | mJ               |
| $E_{AS}$   | $T_C = 25^\circ\text{C}$                                                                                                                | 1.0             | J                |
| $dv/dt$    | $I_S \leq I_{DM}$ , $di/dt \leq 100 \text{ A}/\mu\text{s}$ , $V_{DD} \leq V_{DSS}$ ,<br>$T_J \leq 150^\circ\text{C}$ , $R_G = 5 \Omega$ | 10              | V/ns             |
| $P_D$      | $T_C = 25^\circ\text{C}$                                                                                                                | 360             | W                |
| $T_J$      |                                                                                                                                         | -55 ... +150    | $^\circ\text{C}$ |
| $T_{JM}$   |                                                                                                                                         | 150             | $^\circ\text{C}$ |
| $T_{stg}$  |                                                                                                                                         | -55 ... +150    | $^\circ\text{C}$ |
| $T_L$      | 1.6 mm (0.062 in.) from case for 10 s                                                                                                   | 300             | $^\circ\text{C}$ |
| $T_{SOLD}$ | Plastic body for 10 s                                                                                                                   | 260             | $^\circ\text{C}$ |
| $M_d$      | Mounting torque (TO-3P)                                                                                                                 | 1.13/10         | Nm/lb.in.        |
| Weight     | TO-3P                                                                                                                                   | 6               | g                |
|            | PLUS220 & PLUS220SMD                                                                                                                    | 4               | g                |

TO-3P (IXTQ)



PLUS220 (IXTV)



PLUS220SMD (IXTV...S)



G = Gate  
S = Source  
D = Drain  
TAB = Drain

| Symbol       | Test Conditions                                                                                                  | Characteristic Values |      |                      |
|--------------|------------------------------------------------------------------------------------------------------------------|-----------------------|------|----------------------|
|              |                                                                                                                  | Min.                  | Typ. | Max.                 |
| $BV_{DSS}$   | $V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$                                                                 | 600                   |      | V                    |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$                                                                      | 3.0                   |      | 5.5 V                |
| $I_{GSS}$    | $V_{GS} = \pm 30 \text{ V}$ , $V_{DS} = 0$                                                                       |                       |      | $\pm 100 \text{ nA}$ |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$                                                                                               |                       |      | 25 $\mu\text{A}$     |
|              | $V_{GS} = 0 \text{ V}$ , $T_J = 125^\circ\text{C}$                                                               |                       |      | 250 $\mu\text{A}$    |
| $R_{DS(on)}$ | $V_{GS} = 10 \text{ V}$ , $I_D = 0.5 I_{D25}$<br>Pulse test, $t \leq 300 \mu\text{s}$ , duty cycle $d \leq 2 \%$ |                       |      | 420 $\text{m}\Omega$ |

## Features

- International standard packages
- Unclamped Inductive Switching (UIS) rated
- Low package inductance
- easy to drive and to protect

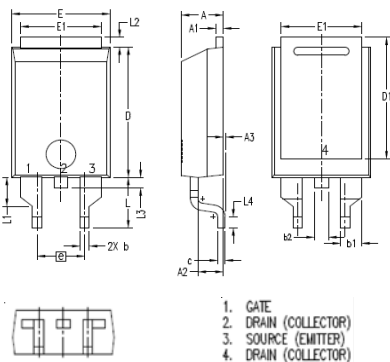
## Advantages

- Easy to mount
- Space savings
- High power density

| Symbol       | Test Conditions                                                                             | Characteristic Values<br>( $T_j = 25^\circ\text{C}$ , unless otherwise specified) |      |                          |
|--------------|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|--------------------------|
|              |                                                                                             | Min.                                                                              | Typ. | Max.                     |
| $g_{fs}$     | $V_{DS} = 20\text{ V}; I_D = 0.5 I_{D25}$ , pulse test                                      | 9                                                                                 | 16   | S                        |
| $C_{iss}$    | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                               |                                                                                   | 2500 | pF                       |
| $C_{oss}$    |                                                                                             |                                                                                   | 278  | pF                       |
| $C_{rss}$    |                                                                                             |                                                                                   | 23   | pF                       |
| $t_{d(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 V_{DSS}, I_D = I_{D25}$<br>$R_G = 5\ \Omega$ (External) |                                                                                   | 21   | ns                       |
| $t_r$        |                                                                                             |                                                                                   | 22   | ns                       |
| $t_{d(off)}$ |                                                                                             |                                                                                   | 62   | ns                       |
| $t_f$        |                                                                                             |                                                                                   | 22   | ns                       |
| $Q_{g(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 V_{DSS}, I_D = 0.5 I_{D25}$                             |                                                                                   | 49   | nC                       |
| $Q_{gs}$     |                                                                                             |                                                                                   | 15   | nC                       |
| $Q_{gd}$     |                                                                                             |                                                                                   | 17   | nC                       |
| $R_{thJC}$   | (TO-3P, PLUS220)                                                                            |                                                                                   | 0.21 | $0.35\ ^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                             |                                                                                   |      | $^\circ\text{C/W}$       |

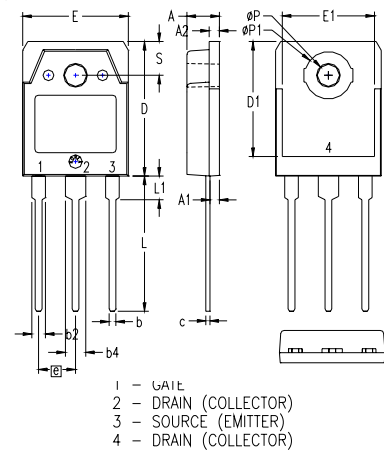
| Source-Drain Diode |                                                                                                       | Characteristic Values<br>( $T_j = 25^\circ\text{C}$ , unless otherwise specified) |      |       |
|--------------------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|-------|
| Symbol             | Test Conditions                                                                                       | Min.                                                                              | Typ. | Max.  |
| $I_S$              | $V_{GS} = 0\text{ V}$                                                                                 |                                                                                   |      | 18 A  |
| $I_{SM}$           | Repetitive                                                                                            |                                                                                   |      | 54 A  |
| $V_{SD}$           | $I_F = I_S, V_{GS} = 0\text{ V}$ ,<br>Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $d \leq 2\%$ |                                                                                   |      | 1.5 V |
| $t_{rr}$           | $I_F = 18\text{ A}, -di/dt = 100\text{ A}/\mu\text{s}$<br>$V_R = 100\text{ V}$                        |                                                                                   | 500  | ns    |

## PLUS220SMD (IXTV\_S) Outline



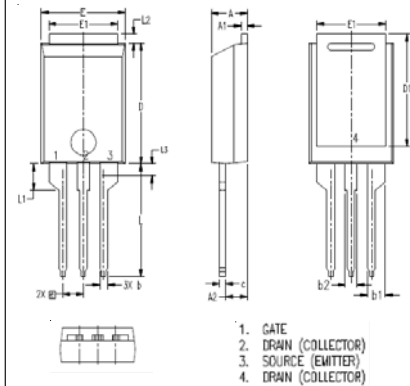
| SYM | INCHES   |      | MILLIMETER |       |
|-----|----------|------|------------|-------|
|     | MIN      | MAX  | MIN        | MAX   |
| A   | .169     | .185 | 4.30       | 4.70  |
| A1  | .028     | .035 | 0.70       | 0.90  |
| A2  | .098     | .118 | 2.50       | 3.00  |
| A3  | .000     | .010 | 0.00       | 0.25  |
| b   | .035     | .047 | 0.90       | 1.20  |
| b1  | .080     | .095 | 2.03       | 2.41  |
| b2  | .054     | .064 | 1.37       | 1.63  |
| c   | .028     | .035 | 0.70       | 0.90  |
| D   | .551     | .591 | 14.00      | 15.00 |
| D1  | .512     | .539 | 13.00      | 13.70 |
| E   | .394     | .433 | 10.00      | 11.00 |
| E1  | .331     | .346 | 8.40       | 8.80  |
| e   | .200 BSC |      | 5.08 BSC   |       |
| L   | .209     | .228 | 5.30       | 5.80  |
| L1  | .118     | .138 | 3.00       | 3.50  |
| L2  | .035     | .051 | 0.90       | 1.30  |
| L3  | .047     | .059 | 1.20       | 1.50  |
| L4  | .039     | .059 | 1.00       | 1.50  |

## 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  |
| $\phi P$  | .126     | .134 | 3.20        | 3.40  |
| $\phi P1$ | .272     | .280 | 6.90        | 7.10  |
| S         | .193     | .201 | 4.90        | 5.10  |

## PLUS220 (IXTV) Outline

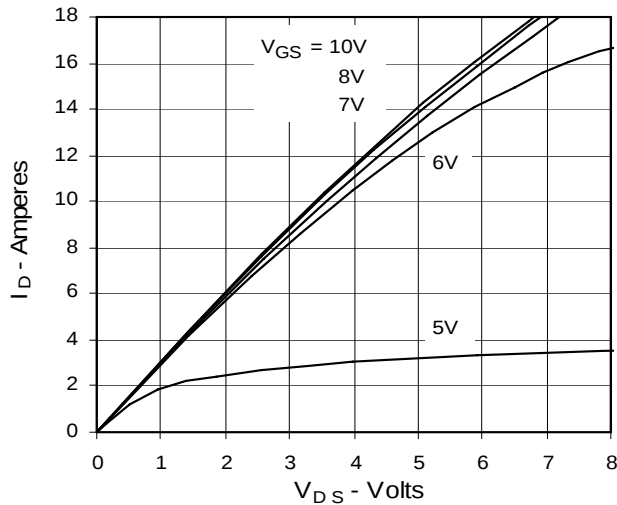


| SYM | INCHES   |      | MILLIMETER |       |
|-----|----------|------|------------|-------|
|     | MIN      | MAX  | MIN        | MAX   |
| A   | .169     | .185 | 4.30       | 4.70  |
| A1  | .028     | .035 | 0.70       | 0.90  |
| A2  | .098     | .118 | 2.50       | 3.00  |
| b   | .035     | .047 | 0.90       | 1.20  |
| b1  | .080     | .095 | 2.03       | 2.41  |
| b2  | .054     | .064 | 1.37       | 1.63  |
| c   | .028     | .035 | 0.70       | 0.90  |
| D   | .551     | .591 | 14.00      | 15.00 |
| D1  | .512     | .539 | 13.00      | 13.70 |
| E   | .394     | .433 | 10.00      | 11.00 |
| E1  | .331     | .346 | 8.40       | 8.80  |
| e   | .100 BSC |      | 2.54 BSC   |       |
| L   | .512     | .551 | 13.00      | 14.00 |
| L1  | .118     | .138 | 3.00       | 3.50  |
| L2  | .035     | .051 | 0.90       | 1.30  |
| L3  | .047     | .059 | 1.20       | 1.50  |

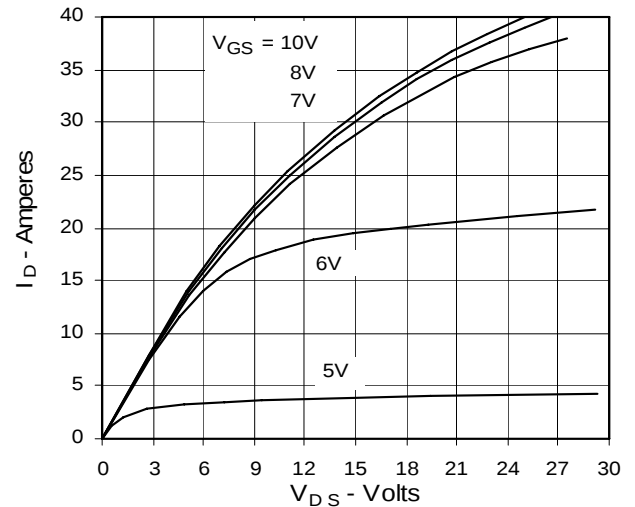
IXYS reserves the right to change limits, test conditions, and dimensions.

IXYS MOSFETs and IGBTs are covered by 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  
one or more of the following U.S. patents: 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  
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

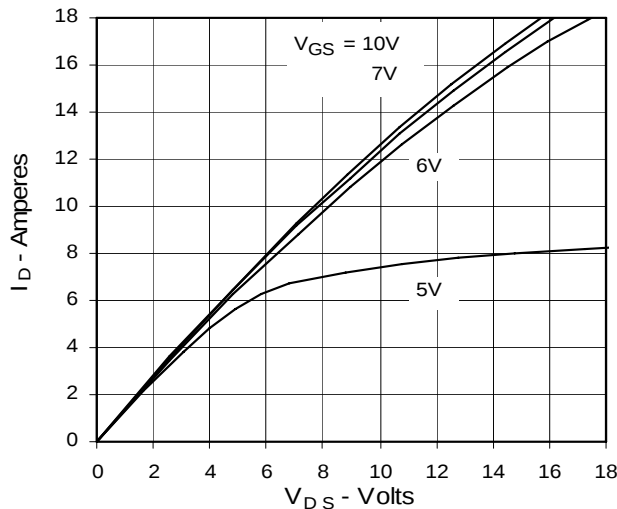
**Fig. 1. Output Characteristics**  
**@ 25°C**



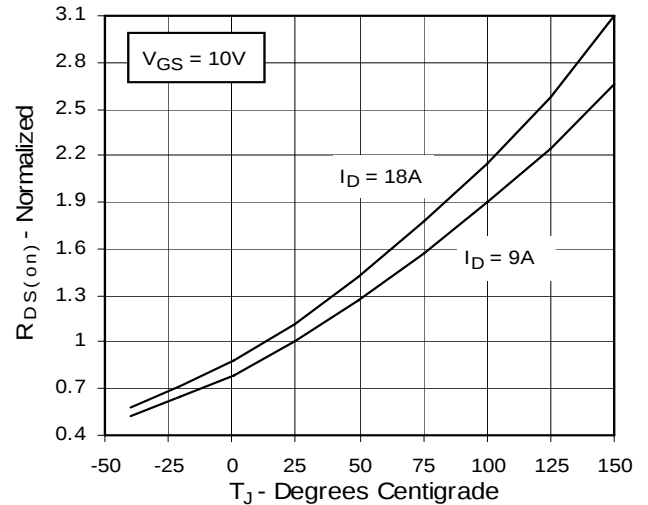
**Fig. 2. Output Characteristics**  
**@ 125°C**



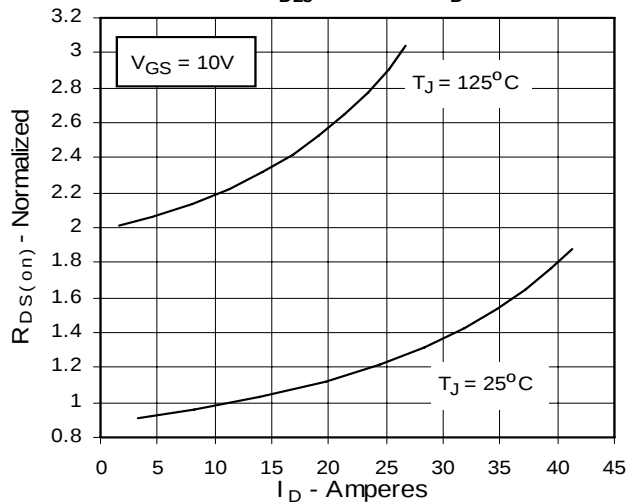
**Fig. 3. Output Characteristics**  
**@ 125°C**



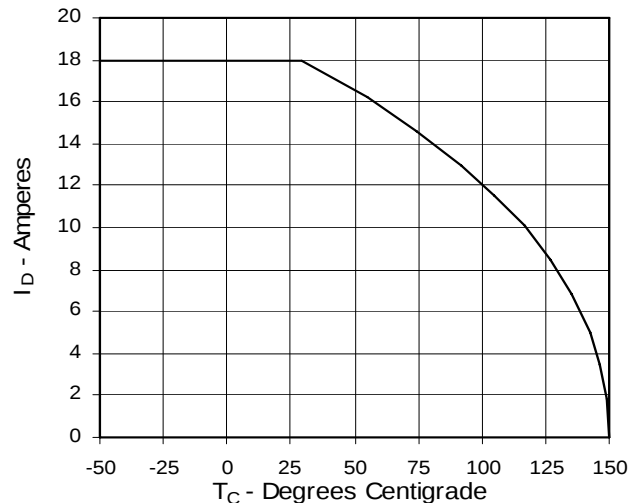
**Fig. 4.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$  Value vs. Junction Temperature**



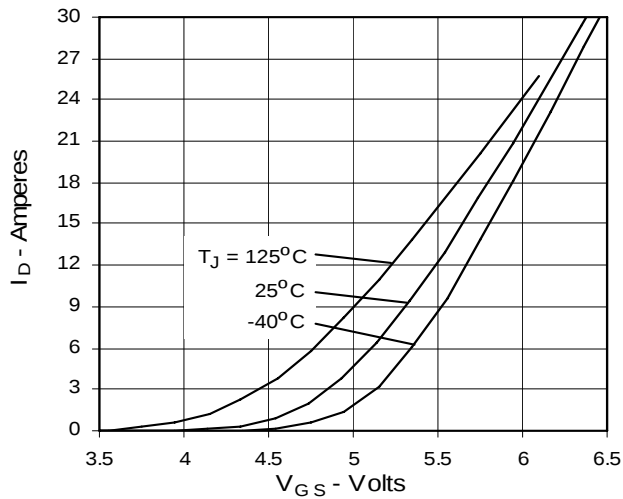
**Fig. 5.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$  Value vs.  $I_D$**



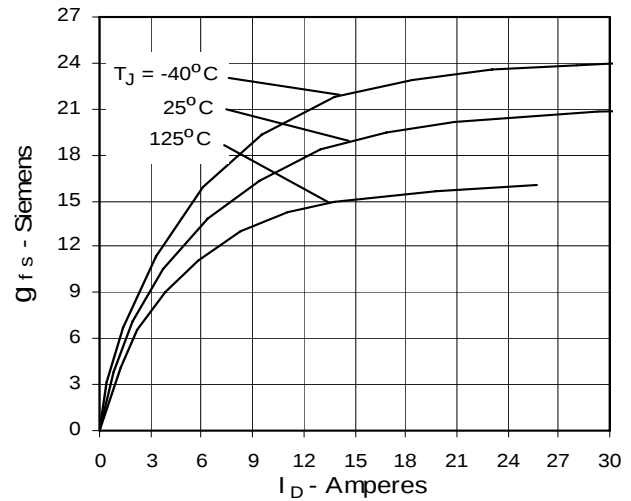
**Fig. 6. Drain Current vs. Case Temperature**



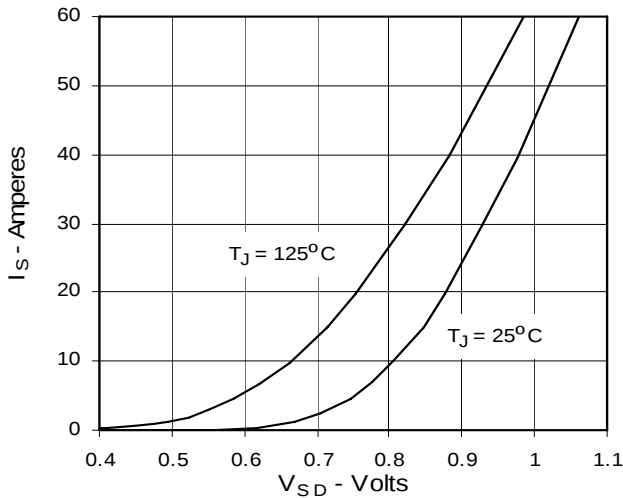
**Fig. 7. Input Admittance**



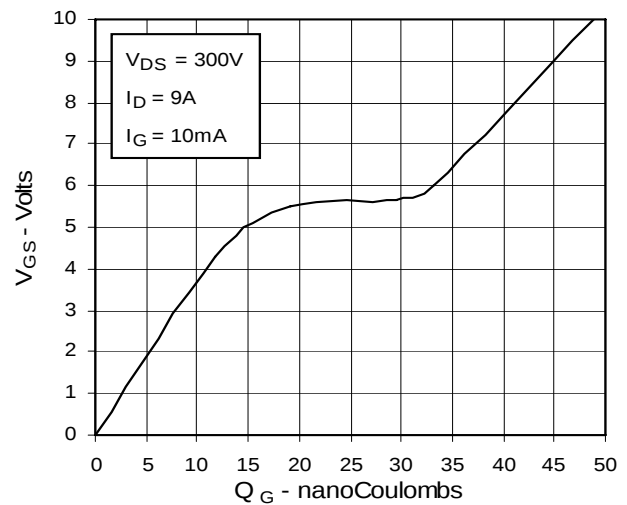
**Fig. 8. Transconductance**



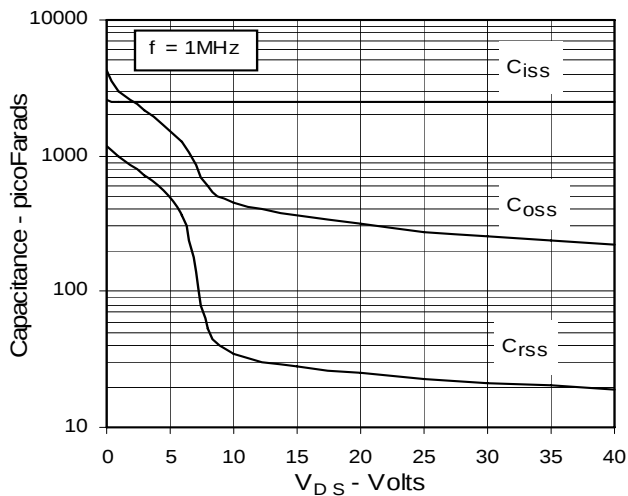
**Fig. 9. Source Current vs. Source-To-Drain Voltage**



**Fig. 10. Gate Charge**



**Fig. 11. Capacitance**



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

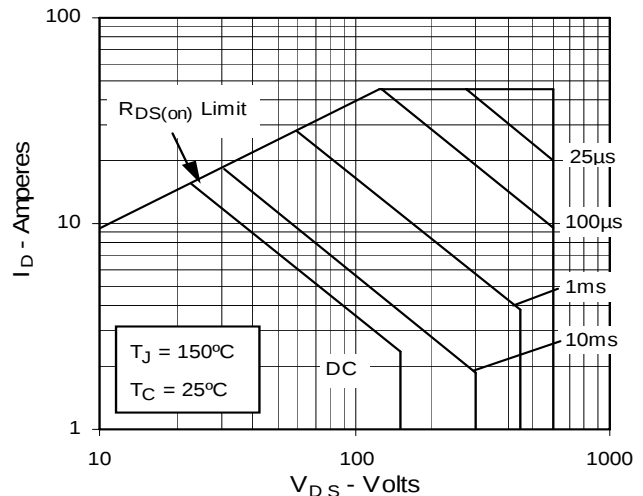
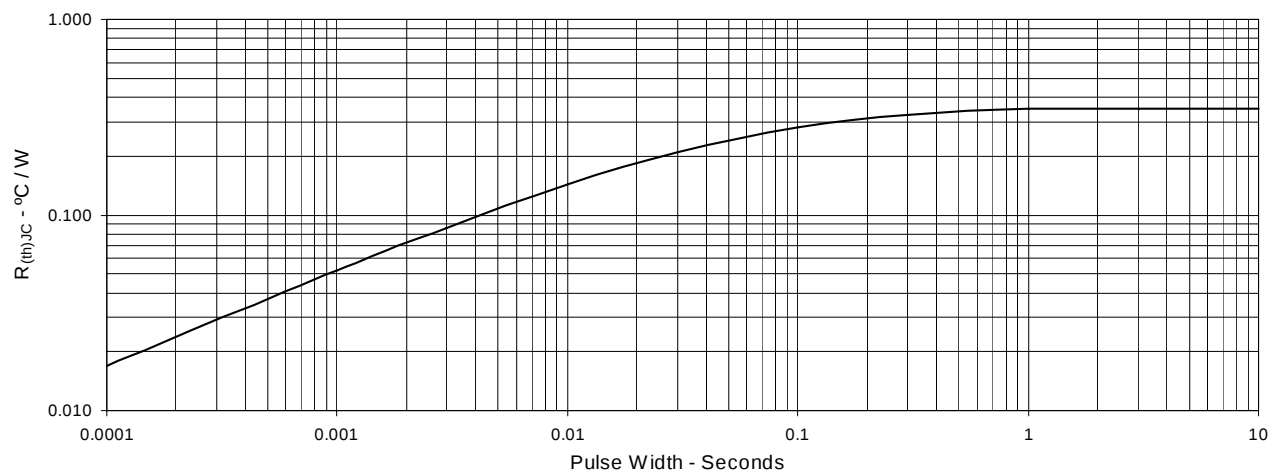


Fig. 13. Maximum Transient Thermal Resistance





---

Disclaimer Notice - Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at [www.littelfuse.com/disclaimer-electronics](http://www.littelfuse.com/disclaimer-electronics).