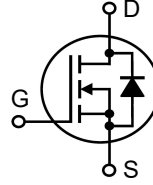


# X3-Class HiPerFET™ Power MOSFET

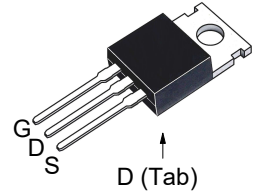
## IXFP34N65X3

$$\begin{aligned} V_{DSS} &= 650V \\ I_{D25} &= 34A \\ R_{DS(on)} &\leq 100m\Omega \end{aligned}$$

N-Channel Enhancement Mode  
Avalanche Rated



TO-220  
(IXFP)



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

| Symbol    | Test Conditions                                                                | Maximum Ratings |                  |
|-----------|--------------------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$ | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$                                 | 650             | V                |
| $V_{DGR}$ | $T_J = 25^\circ\text{C to } 150^\circ\text{C}, R_{GS} = 1M\Omega$              | 650             | V                |
| $V_{GSS}$ | Continuous                                                                     | $\pm 20$        | V                |
| $V_{GSM}$ | Transient                                                                      | $\pm 30$        | V                |
| $I_{D25}$ | $T_C = 25^\circ\text{C}$                                                       | 34              | A                |
| $I_{DM}$  | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$                     | 48              | A                |
| $I_A$     | $T_C = 25^\circ\text{C}$                                                       | 5               | A                |
| $E_{AS}$  | $T_C = 25^\circ\text{C}$                                                       | 750             | mJ               |
| $dv/dt$   | $I_S \leq I_{DM}, V_{DD} \leq V_{DSS}, T_J \leq 150^\circ\text{C}$             | 50              | V/ns             |
| $P_D$     | $T_C = 25^\circ\text{C}$                                                       | 446             | W                |
| $T_J$     |                                                                                | -55 ... +150    | $^\circ\text{C}$ |
| $T_{JM}$  |                                                                                | 150             | $^\circ\text{C}$ |
| $T_{stg}$ |                                                                                | -55 ... +150    | $^\circ\text{C}$ |
| $T_L$     | Maximum Lead Temperature for Soldering<br>1.6 mm (0.062 in.) from Case for 10s | 300             | $^\circ\text{C}$ |
| $M_d$     | Mounting Torque                                                                | 1.13 / 10       | Nm/lb.in         |
| Weight    |                                                                                | 3               | g                |

### Features

- International Standard Package
- Low  $R_{DS(ON)}$  and  $Q_G$
- Avalanche Rated
- Low Package Inductance

### Advantages

- High Power Density
- Easy to Mount
- Space Savings

### Applications

- Switch-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- PFC Circuits
- AC and DC Motor Drives
- Robotics and Servo Controls

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                          |
|--------------|-----------------------------------------------------------------------------|-----------------------|------|--------------------------|
|              |                                                                             | Min.                  | Typ. | Max.                     |
| $BV_{DSS}$   | $V_{GS} = 0V, I_D = 1mA$                                                    | 650                   |      | V                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 2.5mA$                                              | 3.2                   |      | 5.2 V                    |
| $I_{GSS}$    | $V_{GS} = \pm 20V, V_{DS} = 0V$                                             |                       |      | $\pm 100$ nA             |
| $I_{DSS}$    | $V_{DS} = V_{DSS}, V_{GS} = 0V$<br>$T_J = 125^\circ\text{C}$                |                       |      | 25 $\mu\text{A}$<br>3 mA |
| $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 0.5 \cdot I_{D25}$ , Note 1                            |                       |      | 100 m $\Omega$           |

| 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                                                                                          | 13                                                   | 22   | S                         |
| $R_{Gi}$                            | Gate Input Resistance                                                                                                                               |                                                      | 1.7  | $\Omega$                  |
| $C_{iss}$                           | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                    |                                                      | 2025 | pF                        |
| $C_{oss}$                           |                                                                                                                                                     |                                                      | 2800 | pF                        |
| $C_{rss}$                           |                                                                                                                                                     |                                                      | 2.6  | pF                        |
| <b>Effective Output Capacitance</b> |                                                                                                                                                     |                                                      |      |                           |
| $C_{o(er)}$                         | Energy related                                                                                                                                      | $V_{GS} = 0\text{V}$<br>$V_{DS} = 0.8 \cdot V_{DSS}$ | 100  | pF                        |
| $C_{o(tr)}$                         | Time related                                                                                                                                        |                                                      | 440  | 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) |                                                      | 24   | ns                        |
| $t_r$                               |                                                                                                                                                     |                                                      | 10   | ns                        |
| $t_{d(off)}$                        |                                                                                                                                                     |                                                      | 47   | ns                        |
| $t_f$                               |                                                                                                                                                     |                                                      | 6    | ns                        |
| $Q_{g(on)}$                         | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                                                    |                                                      | 29   | nC                        |
| $Q_{gs}$                            |                                                                                                                                                     |                                                      | 11   | nC                        |
| $Q_{gd}$                            |                                                                                                                                                     |                                                      | 10   | nC                        |
| $R_{thJC}$                          |                                                                                                                                                     |                                                      |      | 0.28 $^{\circ}\text{C/W}$ |
| $R_{thCS}$                          |                                                                                                                                                     |                                                      | 0.50 | $^{\circ}\text{C/W}$      |

#### Source-Drain Diode

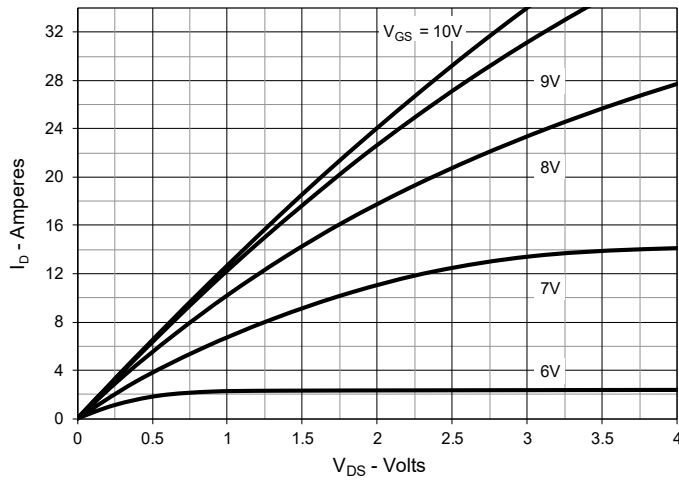
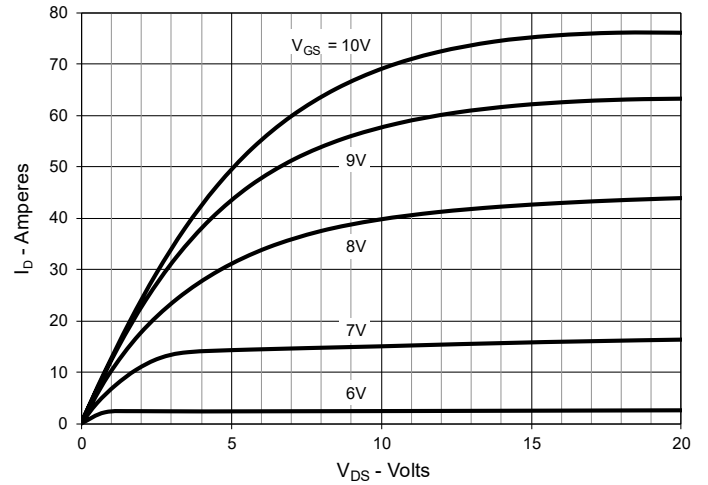
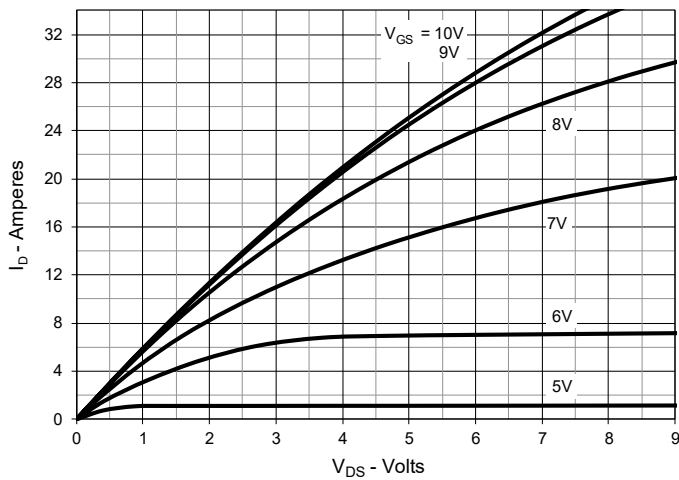
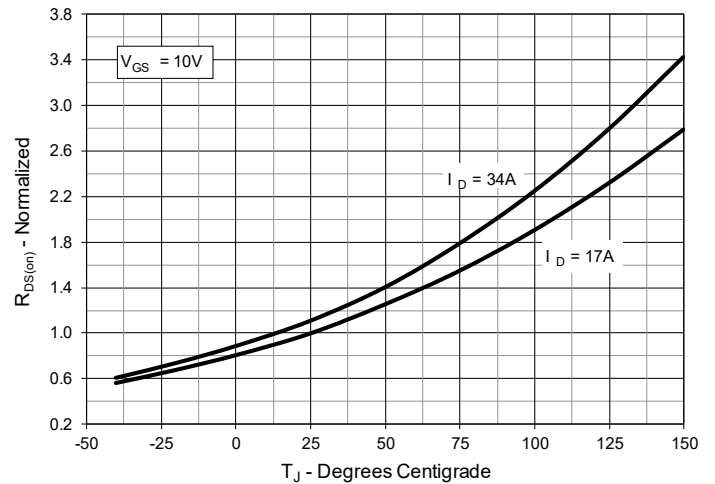
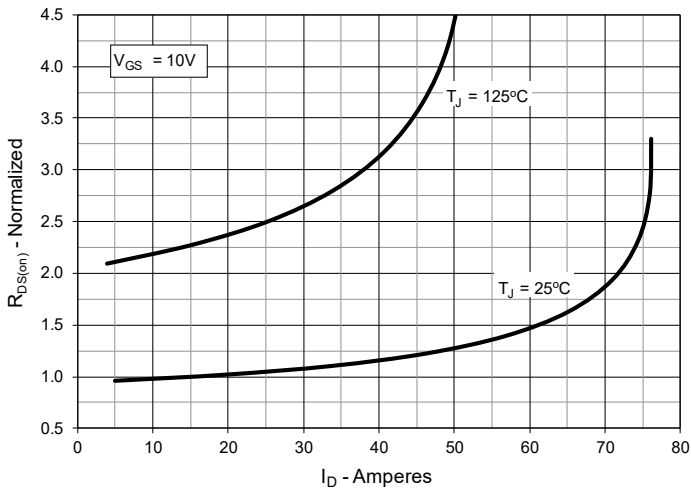
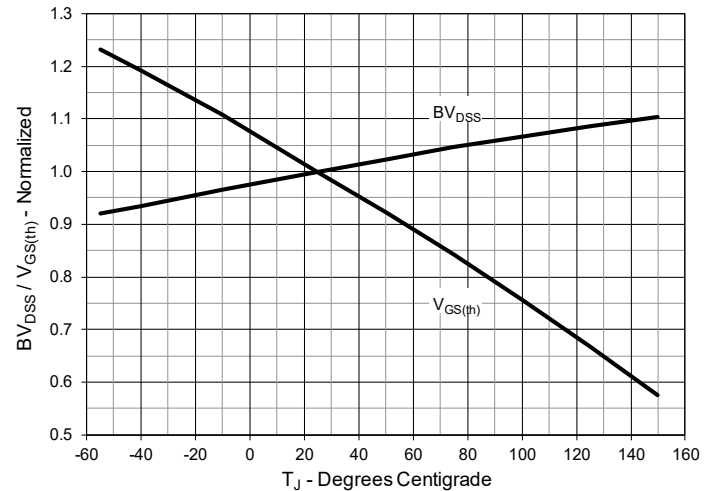
| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)    | Characteristic Values |      |               |
|----------|--------------------------------------------------------------------------------|-----------------------|------|---------------|
|          |                                                                                | Min.                  | Typ. | Max           |
| $I_S$    | $V_{GS} = 0\text{V}$                                                           |                       |      | 34 A          |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                    |                       |      | 136 A         |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                    |                       |      | 1.4 V         |
| $t_{rr}$ | $I_F = 17\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 150  | ns            |
| $Q_{RM}$ |                                                                                |                       | 1.05 | $\mu\text{C}$ |
| $I_{RM}$ |                                                                                |                       | 14.0 | A             |

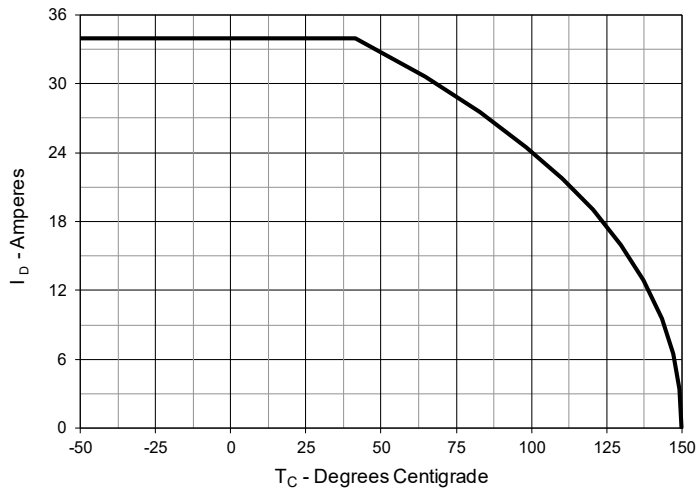
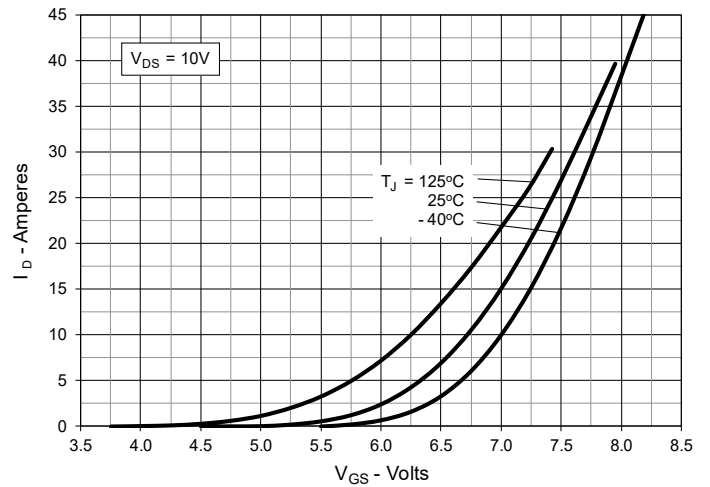
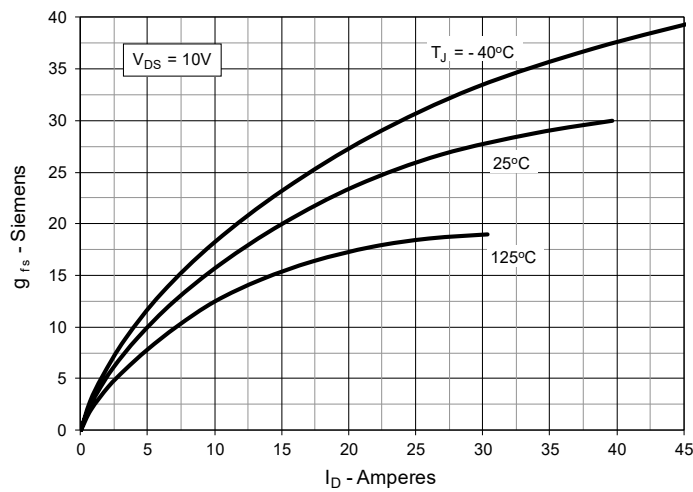
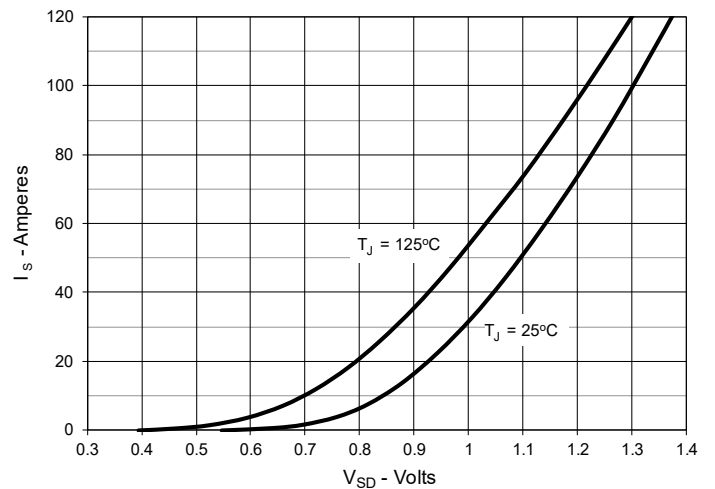
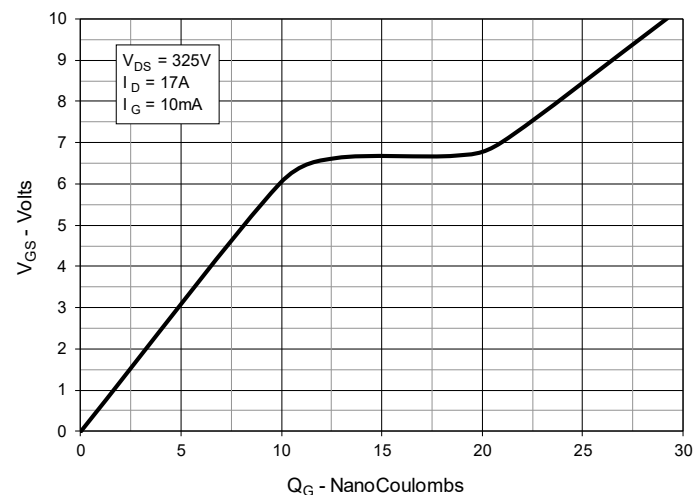
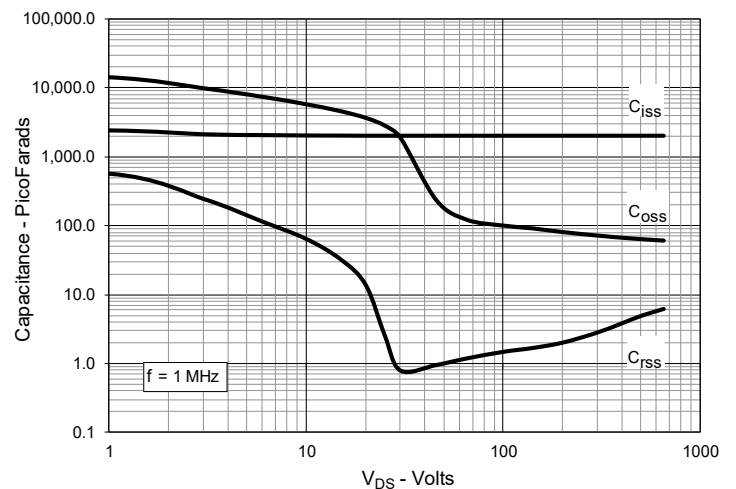
Note 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .

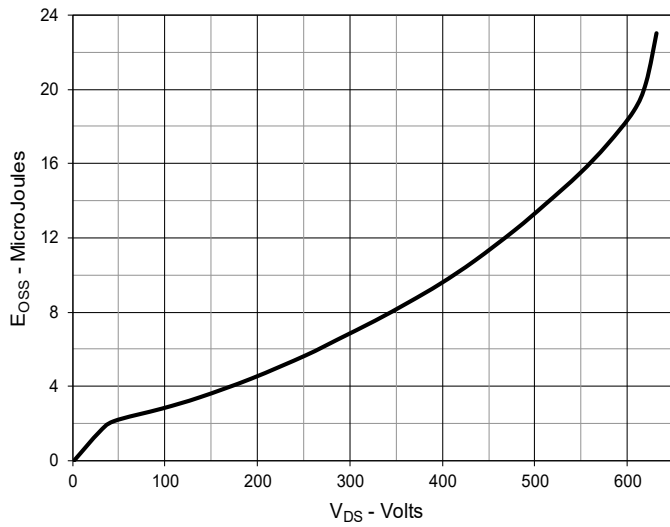
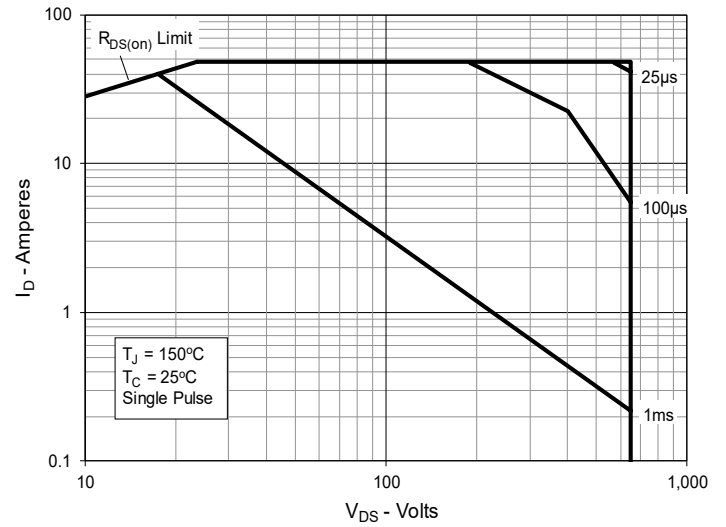
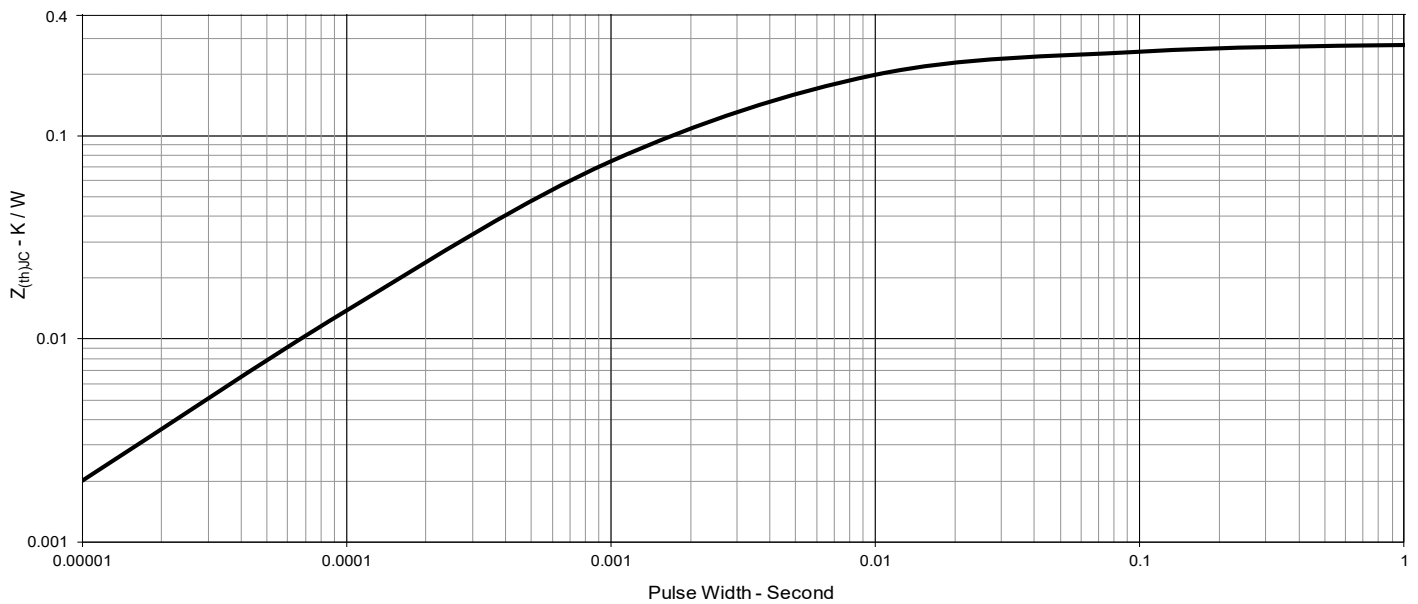
Littelfuse reserves the right to change limits, test conditions and dimensions.

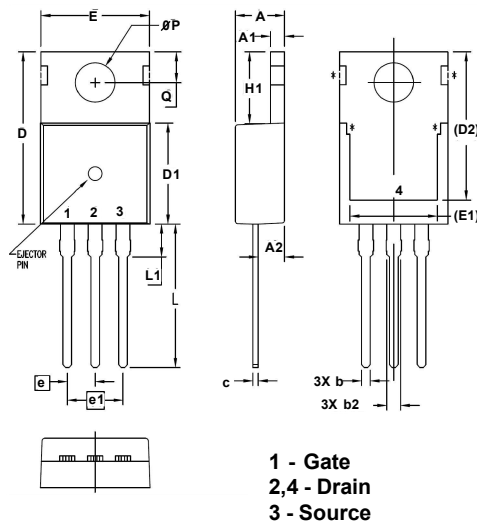
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |             |             |             |             |             |             |
|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|
| 4,835,592 | 4,931,844 | 5,049,961 | 5,237,481 | 6,162,665   | 6,404,065B1 | 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  $I_D = 17\text{A}$  Value vs. Junction Temperature**

**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 17\text{A}$  Value vs. Drain Current**

**Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature**


**Fig. 7. Maximum Drain Current vs. Case Temperature**

**Fig. 8. Input Admittance**

**Fig. 9. Transconductance**

**Fig. 10. Forward Voltage Drop of Intrinsic Diode**

**Fig. 11. Gate Charge**

**Fig. 12. Capacitance**


**Fig. 13. Output Capacitance Stored Energy**

**Fig. 14. Forward-Bias Safe Operating Area**

**Fig. 15. Maximum Transient Thermal Impedance**


**TO-220 Outline**


| SYM  | INCHES   |      | MILLIMETERS |       |
|------|----------|------|-------------|-------|
|      | MIN      | MAX  | MIN         | MAX   |
| A    | .169     | .185 | 4.30        | 4.70  |
| A1   | .047     | .055 | 1.20        | 1.40  |
| A2   | .079     | .106 | 2.00        | 2.70  |
| b    | .024     | .039 | 0.60        | 1.00  |
| b2   | .045     | .057 | 1.15        | 1.45  |
| c    | .014     | .026 | 0.35        | 0.65  |
| D    | .587     | .626 | 14.90       | 15.90 |
| D1   | .335     | .370 | 8.50        | 9.40  |
| (D2) | .500     | .531 | 12.70       | 13.50 |
| E    | .382     | .406 | 9.70        | 10.30 |
| (E1) | .283     | .323 | 7.20        | 8.20  |
| e    | .100 BSC |      | 2.54 BSC    |       |
| e1   | .200 BSC |      | 5.08 BSC    |       |
| H1   | .244     | .268 | 6.20        | 6.80  |
| L    | .492     | .547 | 12.50       | 13.90 |
| L1   | .110     | .154 | 2.80        | 3.90  |
| ØP   | .134     | .150 | 3.40        | 3.80  |
| Q    | .106     | .126 | 2.70        | 3.20  |