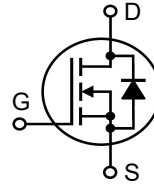


# X3-Class HiPerFET™ Power MOSFET

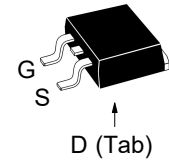
## IXFA36N60X3

$$\begin{aligned} V_{DSS} &= 600V \\ I_{D25} &= 36A \\ R_{DS(on)} &\leq 90m\Omega \end{aligned}$$

N-Channel Enhancement Mode  
Avalanche Rated



TO-263  
(IXFA)



| Symbol     | Test Conditions                                                    | Maximum Ratings    |                  |
|------------|--------------------------------------------------------------------|--------------------|------------------|
| $V_{DSS}$  | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$                     | 600                | V                |
| $V_{DGR}$  | $T_J = 25^\circ\text{C to } 150^\circ\text{C}, R_{GS} = 1M\Omega$  | 600                | V                |
| $V_{GSS}$  | Continuous                                                         | $\pm 20$           | V                |
| $V_{GSM}$  | Transient                                                          | $\pm 30$           | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$                                           | 36                 | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$         | 48                 | A                |
| $I_A$      | $T_C = 25^\circ\text{C}$                                           | 8                  | 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       | $^\circ\text{C}$ |
| $T_{SOLD}$ | Plastic Body for 10s                                               | 260                | $^\circ\text{C}$ |
| $F_C$      | Mounting Force                                                     | 10..65 / 2.2..14.6 | N/lb             |
| Weight     |                                                                    | 2.5                | g                |

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

### 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.                     |
| $BV_{DSS}$   | $V_{GS} = 0V, I_D = 1mA$                                                    | 600                   |      | V                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 2.5mA$                                              | 3.5                   |      | 5.0 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>1 mA |
| $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 0.5 \cdot I_{D25}$ , Note 1                            |                       |      | 90 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                                                                                          | 16                                                   | 26   | S                         |
| $R_{Gi}$                            | Gate Input Resistance                                                                                                                               |                                                      | 2.1  | $\Omega$                  |
| $C_{iss}$                           | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                    |                                                      | 2030 | pF                        |
| $C_{oss}$                           |                                                                                                                                                     |                                                      | 3050 | pF                        |
| $C_{rss}$                           |                                                                                                                                                     |                                                      | 3.6  | pF                        |
| <b>Effective Output Capacitance</b> |                                                                                                                                                     |                                                      |      |                           |
| $C_{o(er)}$                         | Energy related                                                                                                                                      | $V_{GS} = 0\text{V}$<br>$V_{DS} = 0.8 \cdot V_{DSS}$ | 110  | pF                        |
| $C_{o(tr)}$                         | Time related                                                                                                                                        |                                                      | 510  | 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) |                                                      | 23   | ns                        |
| $t_r$                               |                                                                                                                                                     |                                                      | 8    | ns                        |
| $t_{d(off)}$                        |                                                                                                                                                     |                                                      | 45   | ns                        |
| $t_f$                               |                                                                                                                                                     |                                                      | 4    | 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                        |
| $Q_{gs}$                            |                                                                                                                                                     |                                                      | 10   | nC                        |
| $Q_{gd}$                            |                                                                                                                                                     |                                                      | 10   | nC                        |
| $R_{thJC}$                          |                                                                                                                                                     |                                                      |      | 0.28 $^{\circ}\text{C/W}$ |

#### Source-Drain Diode

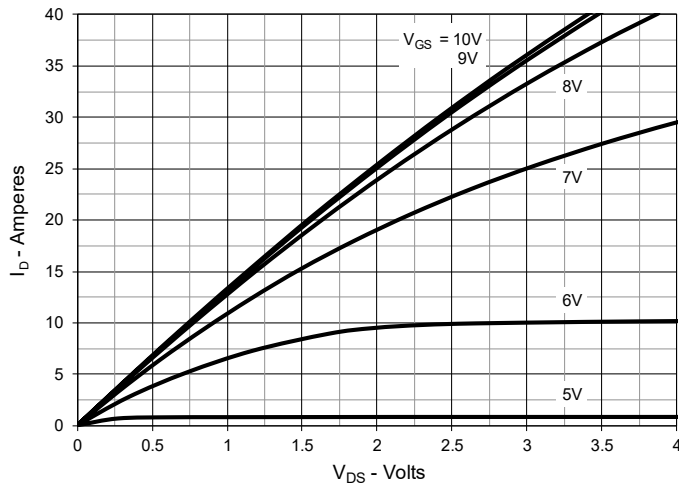
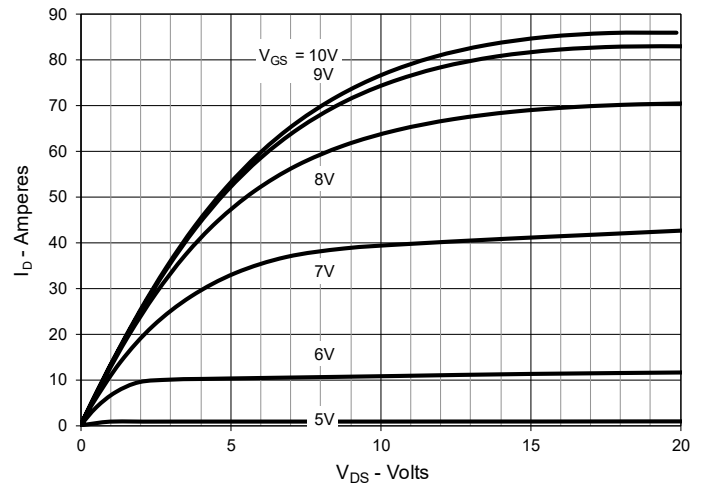
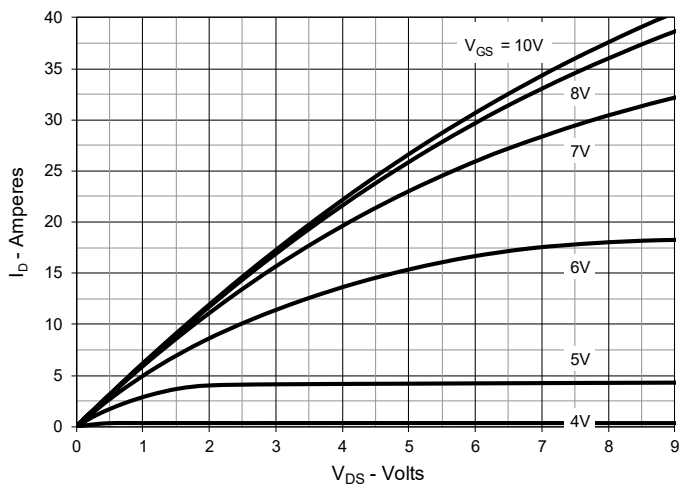
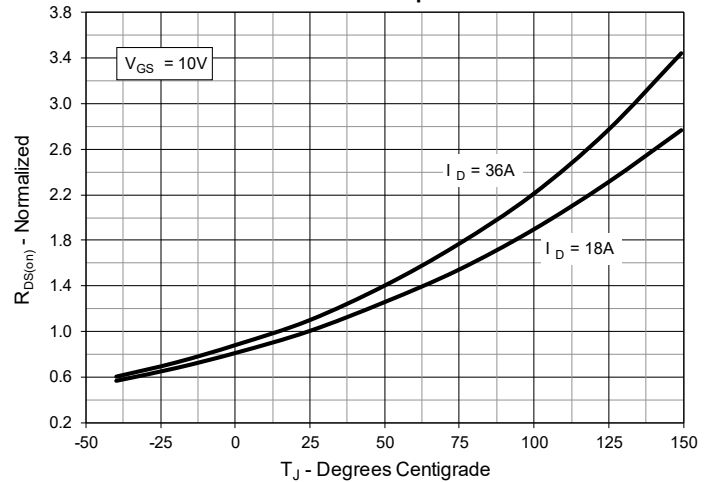
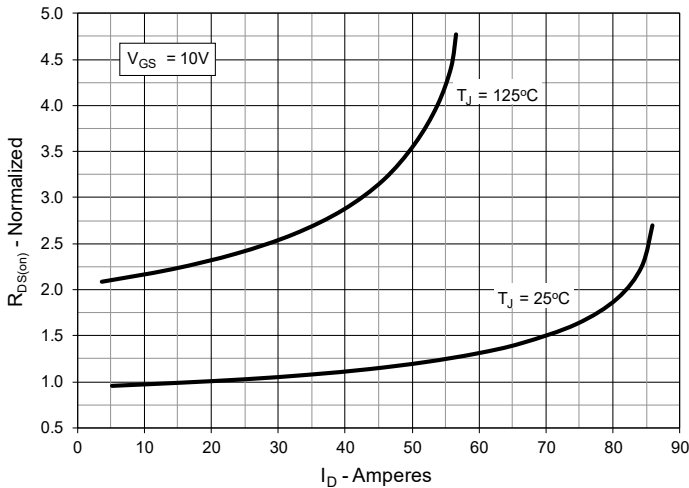
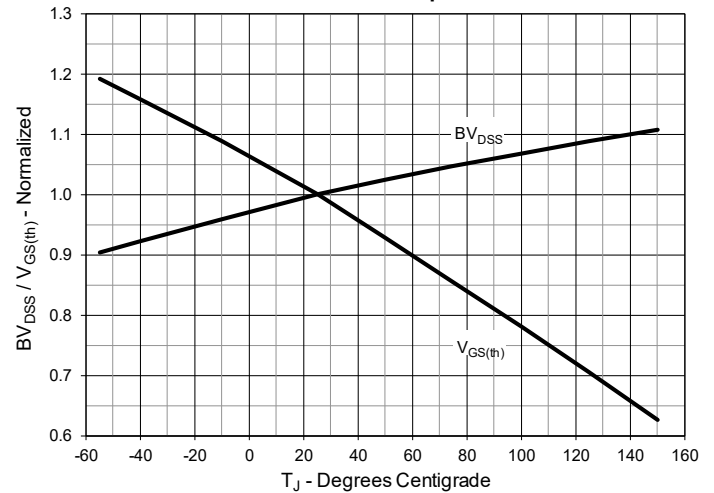
| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)    | Characteristic Values |      |               |
|----------|--------------------------------------------------------------------------------|-----------------------|------|---------------|
|          |                                                                                | Min.                  | Typ. | Max           |
| $I_S$    | $V_{GS} = 0\text{V}$                                                           |                       |      | 36 A          |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                    |                       |      | 144 A         |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                    |                       |      | 1.4 V         |
| $t_{rr}$ | $I_F = 18\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 180  | ns            |
| $Q_{RM}$ |                                                                                |                       | 1.6  | $\mu\text{C}$ |
| $I_{RM}$ |                                                                                |                       | 18.0 | 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  $I_D = 18\text{A}$  Value vs. Junction Temperature**

**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 18\text{A}$  Value vs. Drain Current**

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


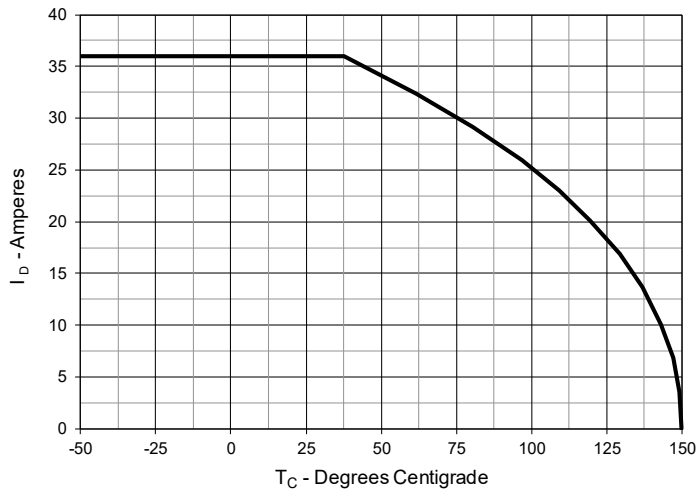
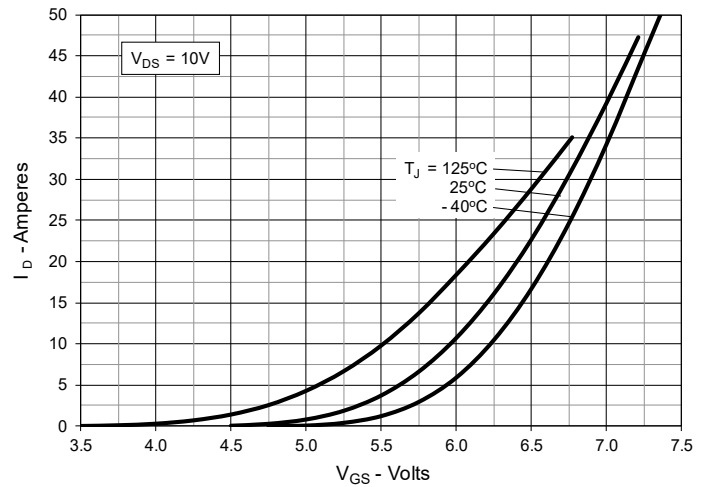
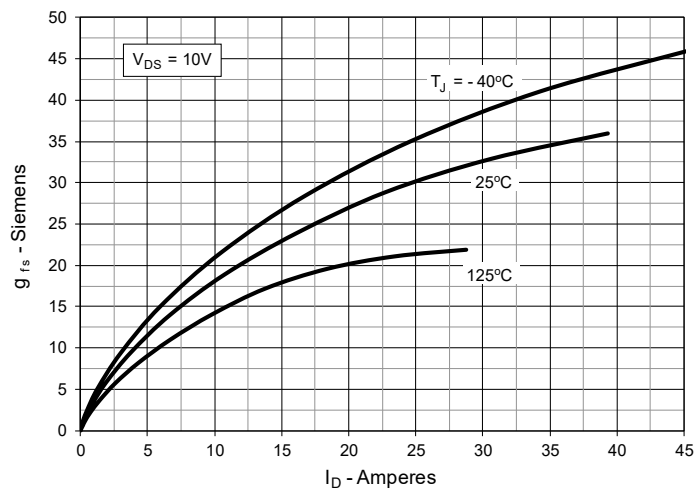
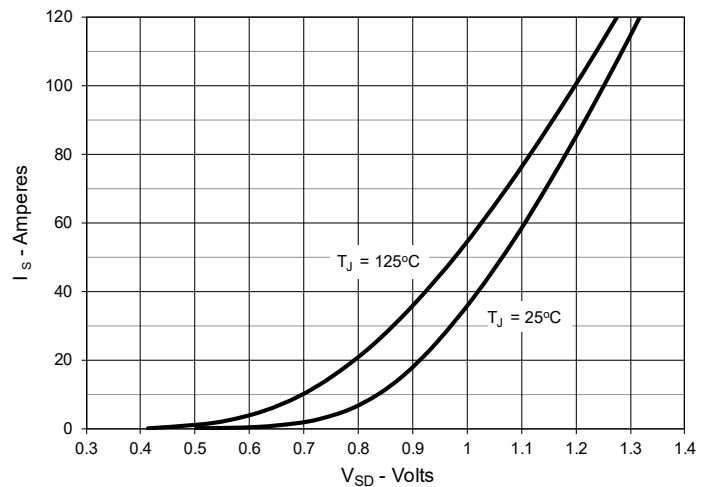
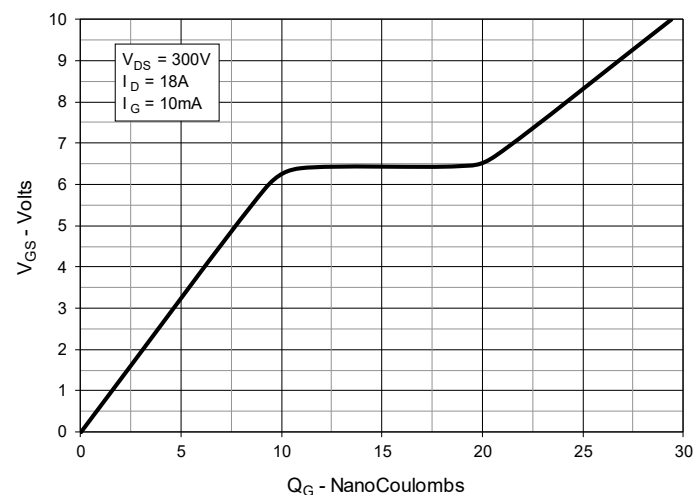
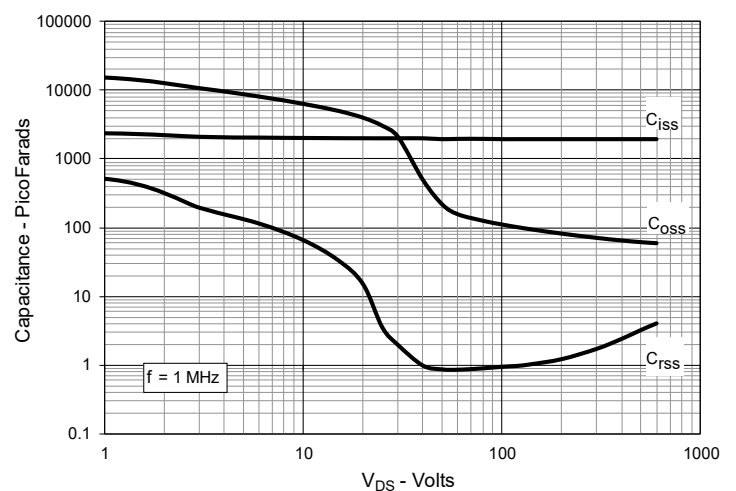
**Fig. 7. Maximum Drain Current vs. Case Temperature**

**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

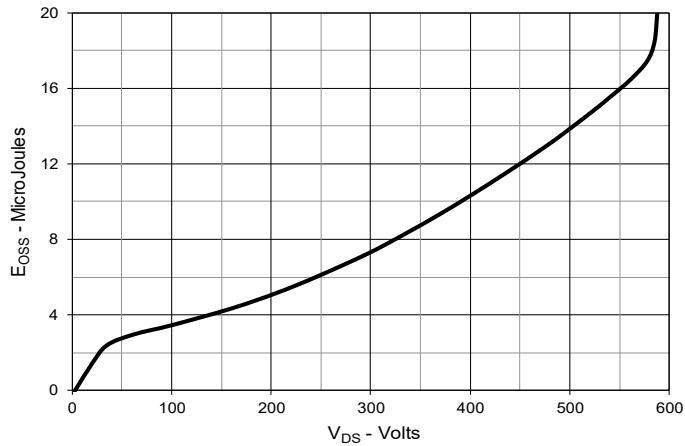


Fig. 14. Forward-Bias Safe Operating Area

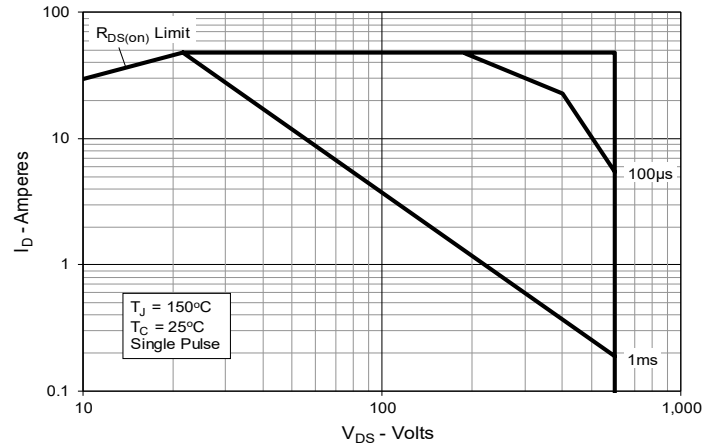
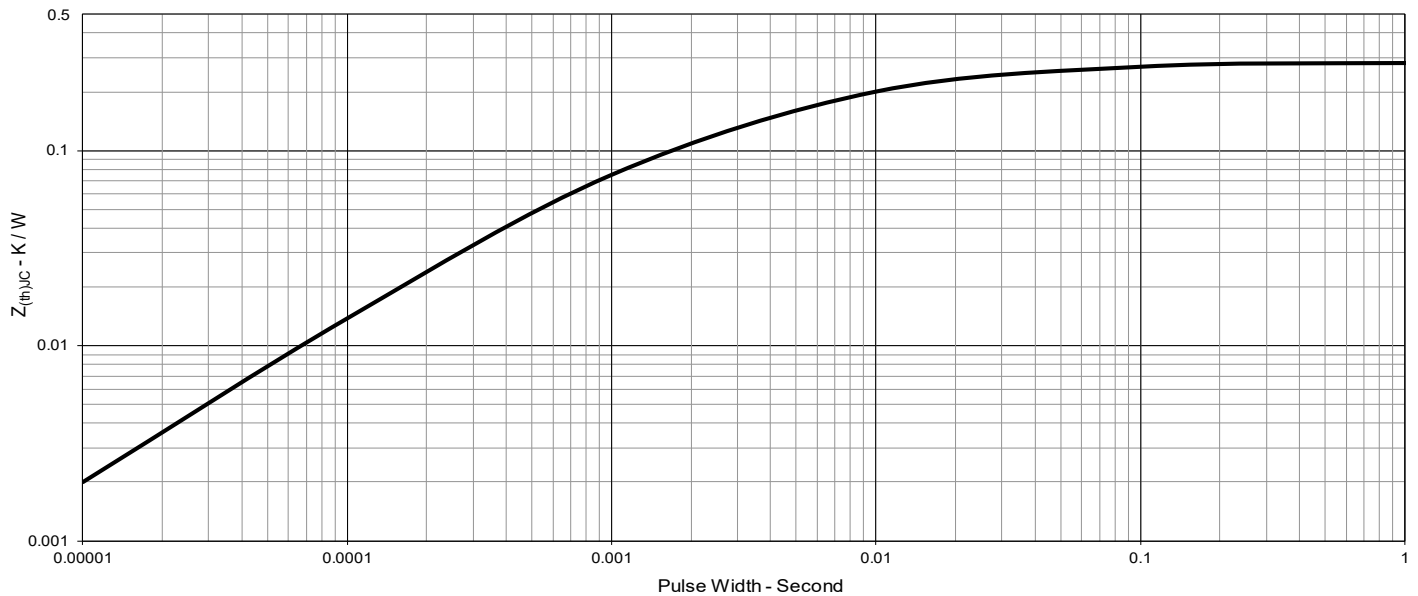
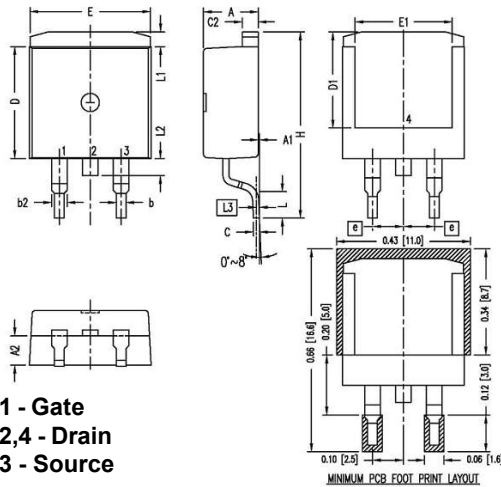


Fig. 15. Maximum Transient Thermal Impedance



**TO-263 Outline**


| SYM | INCHES |      | MILLIMETER |       |
|-----|--------|------|------------|-------|
|     | MIN    | MAX  | MIN        | MAX   |
| A   | .170   | .185 | 4.30       | 4.70  |
| A1  | .000   | .008 | 0.00       | 0.20  |
| A2  | .091   | .098 | 2.30       | 2.50  |
| b   | .028   | .035 | 0.70       | 0.90  |
| b2  | .046   | .060 | 1.18       | 1.52  |
| C   | .018   | .024 | 0.45       | 0.60  |
| C2  | .049   | .060 | 1.25       | 1.52  |
| D   | .340   | .370 | 8.63       | 9.40  |
| D1  | .300   | .327 | 7.62       | 8.30  |
| E   | .380   | .410 | 9.65       | 10.41 |
| E1  | .270   | .330 | 6.86       | 8.38  |
| e   | .100   | BSC  | 2.54       | BSC   |
| H   | .580   | .620 | 14.73      | 15.75 |
| L   | .075   | .105 | 1.91       | 2.67  |
| L1  | .039   | .060 | 1.00       | 1.52  |
| L2  |        | .070 |            | 1.77  |
| L3  | .010   | BSC  | 0.254      | BSC   |

**NOTE:**

1. This drawing meets all dimensions requirement of JEDEC outlines TO-263AB.
2. All metal surface are matte pure tin plated except trimmed area.
3.  is Gauge plane to measure L.
4. These dimension do not include mold flash and they will not exceed 0.005[0.13] per side.

