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# Polar™ Power MOSFET

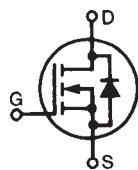
**IXTY3N50P**  
**IXTA3N50P**  
**IXTP3N50P**

$V_{DSS} = 500V$   
 $I_{D25} = 3A$   
 $R_{DS(on)} \leq 2\Omega$

N-Channel Enhancement Mode  
Avalanche Rated

| Symbol     | Test Conditions                                                    | Maximum Ratings    |            |
|------------|--------------------------------------------------------------------|--------------------|------------|
| $V_{DSS}$  | $T_J = 25^\circ C$ to $150^\circ C$                                | 500                | V          |
| $V_{DGR}$  | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$          | 500                | V          |
| $V_{GSS}$  | Continuous                                                         | $\pm 30$           | V          |
| $V_{GSM}$  | Transient                                                          | $\pm 40$           | V          |
| $I_{D25}$  | $T_C = 25^\circ C$                                                 | 3                  | A          |
| $I_{DM}$   | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$               | 8                  | A          |
| $I_A$      | $T_C = 25^\circ C$                                                 | 3                  | A          |
| $E_{AS}$   | $T_C = 25^\circ C$                                                 | 180                | mJ         |
| $dv/dt$    | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ C$ | 10                 | V/ns       |
| $P_D$      | $T_C = 25^\circ C$                                                 | 70                 | 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-220)                                           | 1.13 / 10          | Nm/lb.in   |
| Weight     | TO-252                                                             | 0.35               | g          |
|            | TO-263                                                             | 2.50               | g          |
|            | TO-220                                                             | 3.00               | g          |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |              |
|--------------|-----------------------------------------------------------------------|-----------------------|------|--------------|
|              |                                                                       | Min.                  | Typ. | Max.         |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 250\mu A$                                      | 500                   |      | V            |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 50\mu A$                                   | 3.0                   |      | 5.5 V        |
| $I_{GSS}$    | $V_{GS} = \pm 30V$ , $V_{DS} = 0V$                                    |                       |      | $\pm 100$ nA |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 125^\circ C$             |                       |      | 5 $\mu A$    |
|              |                                                                       |                       |      | 50 $\mu A$   |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                   |                       |      | 2 $\Omega$   |



TO-252 (IXTY)

TO-263 (IXTA)

TO-220 (IXTP)

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

## Features

- International Standard Packages
- Low  $Q_G$
- Avalanche Rated
- Low Package Inductance
- Fast Intrinsic Rectifier

## Advantages

- High Power Density
- Easy to Mount
- Space Savings

## Applications

- DC-DC Converters
- Switch-Mode and Resonant-Mode Power Supplies
- AC and DC Motor Drives
- Discharge Circuits in Lasers, Spark Igniters, RF Generators
- High Voltage Pulse Power 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                                                                                          | 2.5                   | 3.5  | S                      |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                    |                       | 409  | pF                     |
| $C_{oss}$    |                                                                                                                                                     |                       | 48   | pF                     |
| $C_{rss}$    |                                                                                                                                                     |                       | 6.1  | pF                     |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                                                    |                       | 9.3  | nC                     |
| $Q_{gs}$     |                                                                                                                                                     |                       | 3.3  | nC                     |
| $Q_{gd}$     |                                                                                                                                                     |                       | 3.4  | nC                     |
| $t_{d(on)}$  | <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>$R_G = 20\Omega$ (External) |                       | 15   | ns                     |
| $t_r$        |                                                                                                                                                     |                       | 15   | ns                     |
| $t_{d(off)}$ |                                                                                                                                                     |                       | 38   | ns                     |
| $t_f$        |                                                                                                                                                     |                       | 12   | ns                     |
| $R_{thJC}$   | TO-220                                                                                                                                              |                       |      | 1.8 $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                     | 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   |
| $I_S$    | $V_{GS} = 0\text{V}$                                                         |                       |      | 3 A   |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                  |                       |      | 9 A   |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                  |                       |      | 1.5 V |
| $t_{rr}$ | $I_F = 3\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$ , $V_R = 100\text{V}$ |                       | 400  | ns    |

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

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   | 6,404,065B1 | 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   |             |

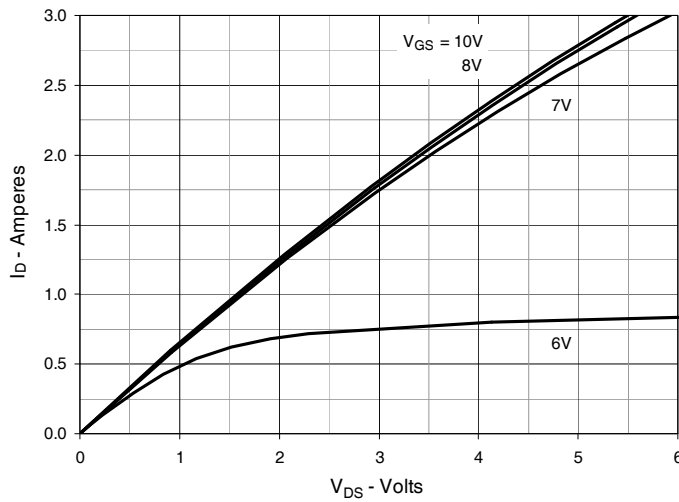
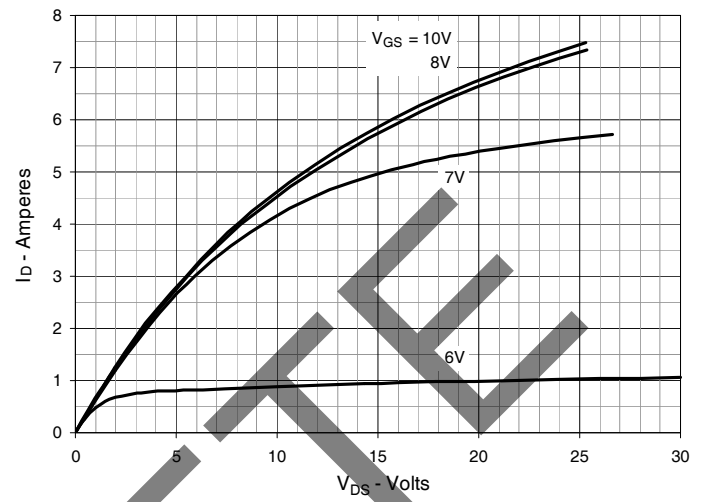
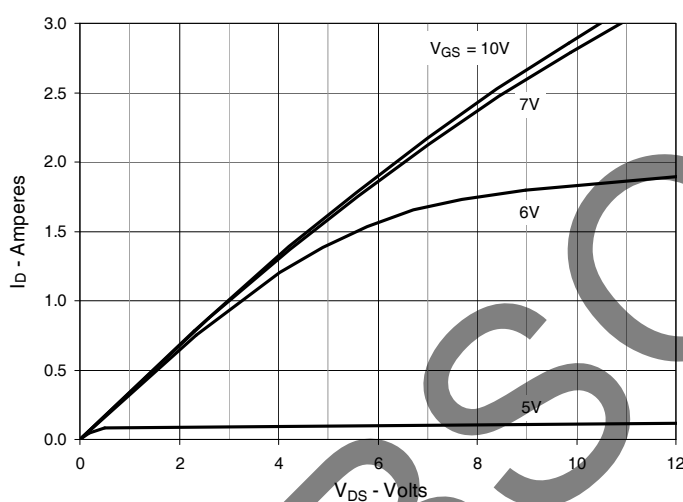
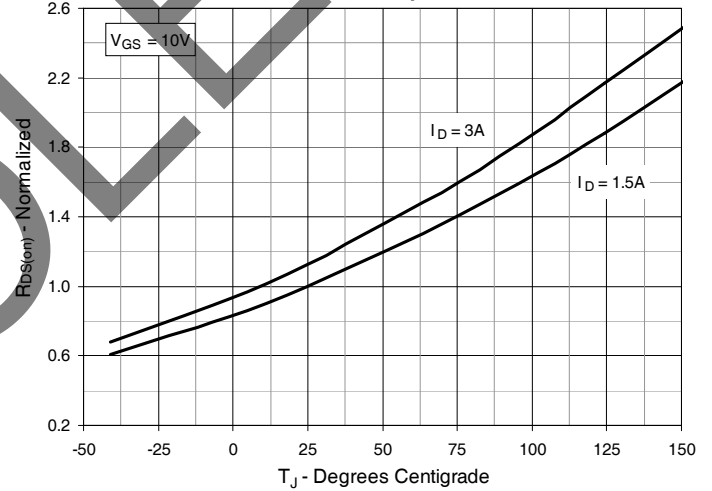
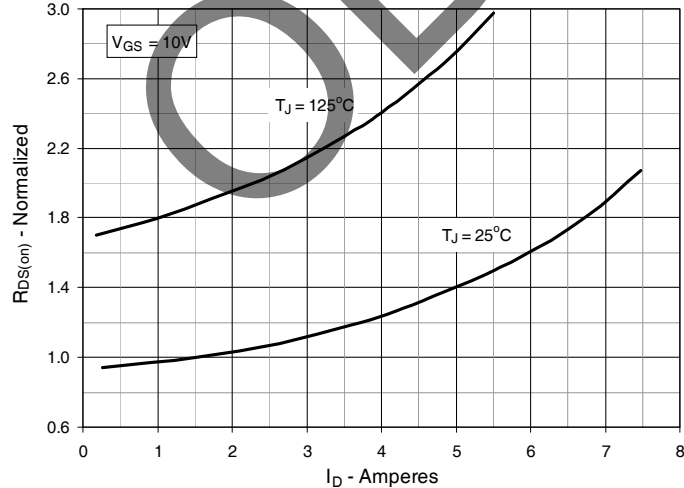
Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$ 

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  $I_D = 1.5\text{A}$  Value vs. Junction Temperature

Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 1.5\text{A}$  Value vs. Drain Current


Fig. 6. Maximum Drain Current vs. Case Temperature

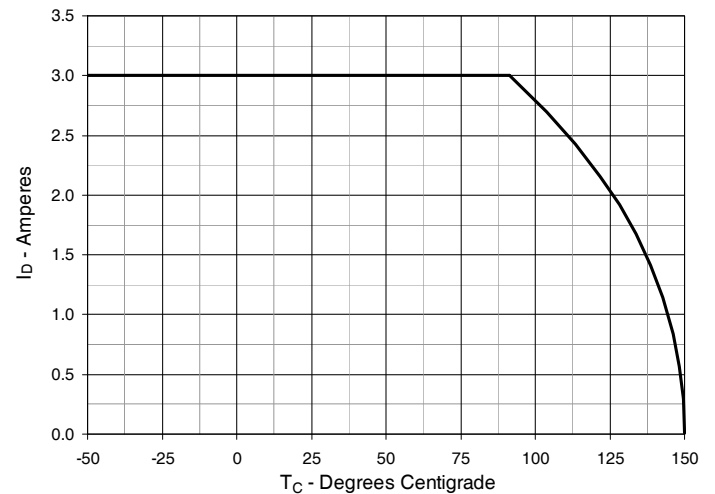


Fig. 7. Input Admittance

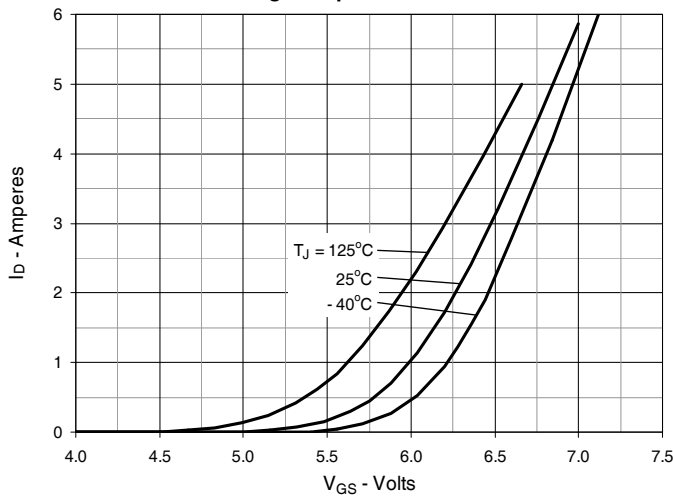


Fig. 8. Transconductance

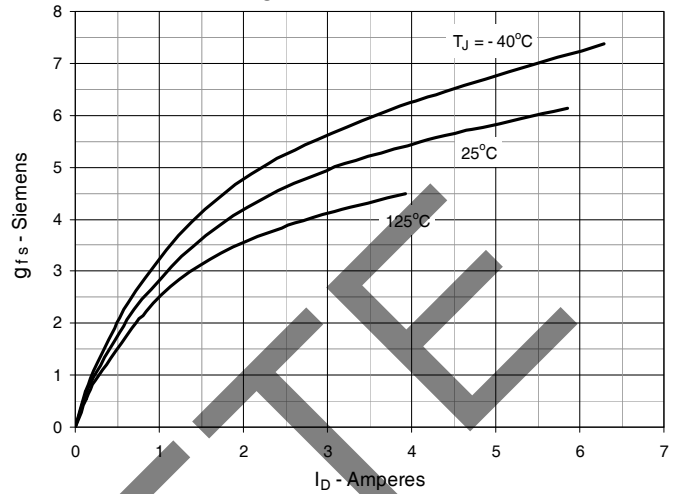


Fig. 9. Forward Voltage Drop of Intrinsic Diode

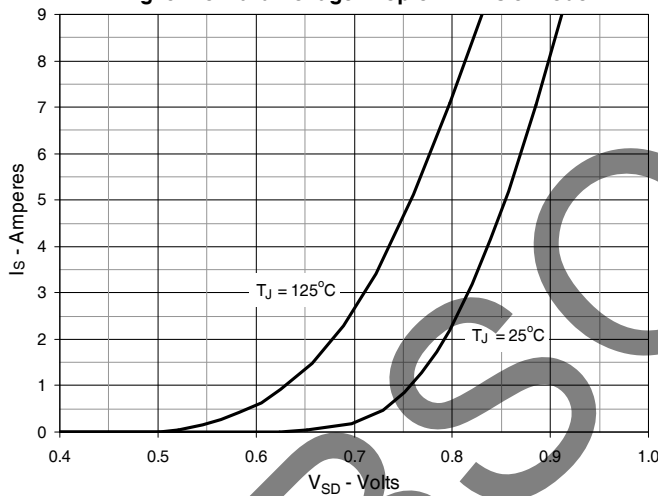


Fig. 10. Gate Charge

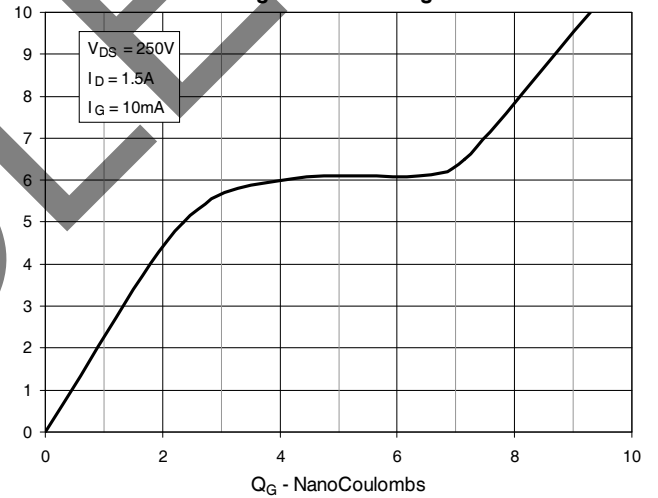


Fig. 11. Capacitance

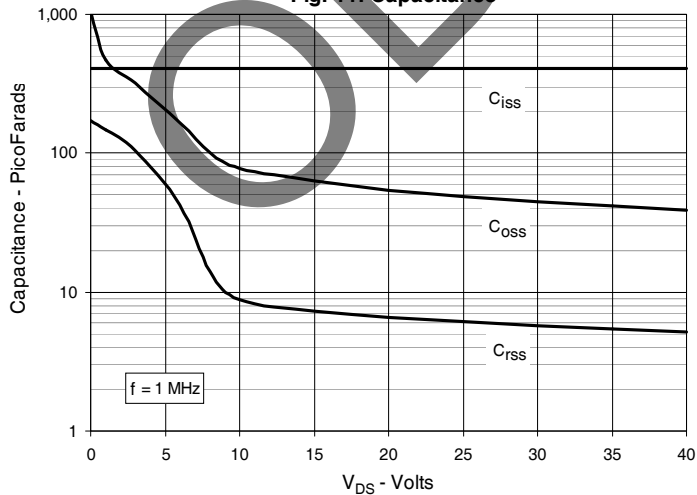


Fig. 12. Forward-Bias Safe Operating Area

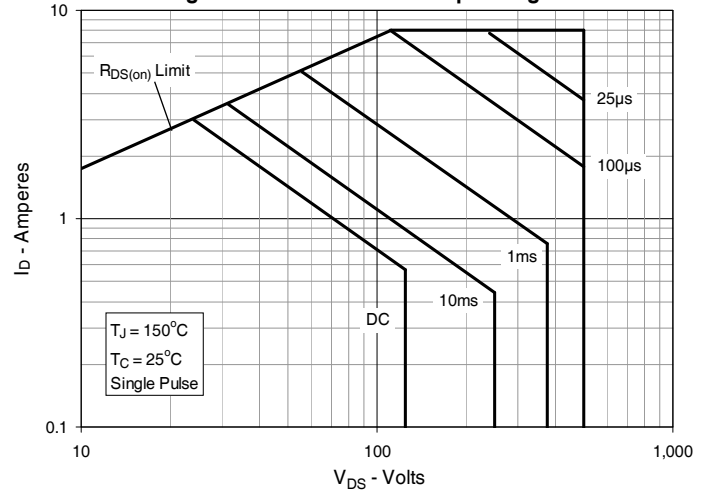
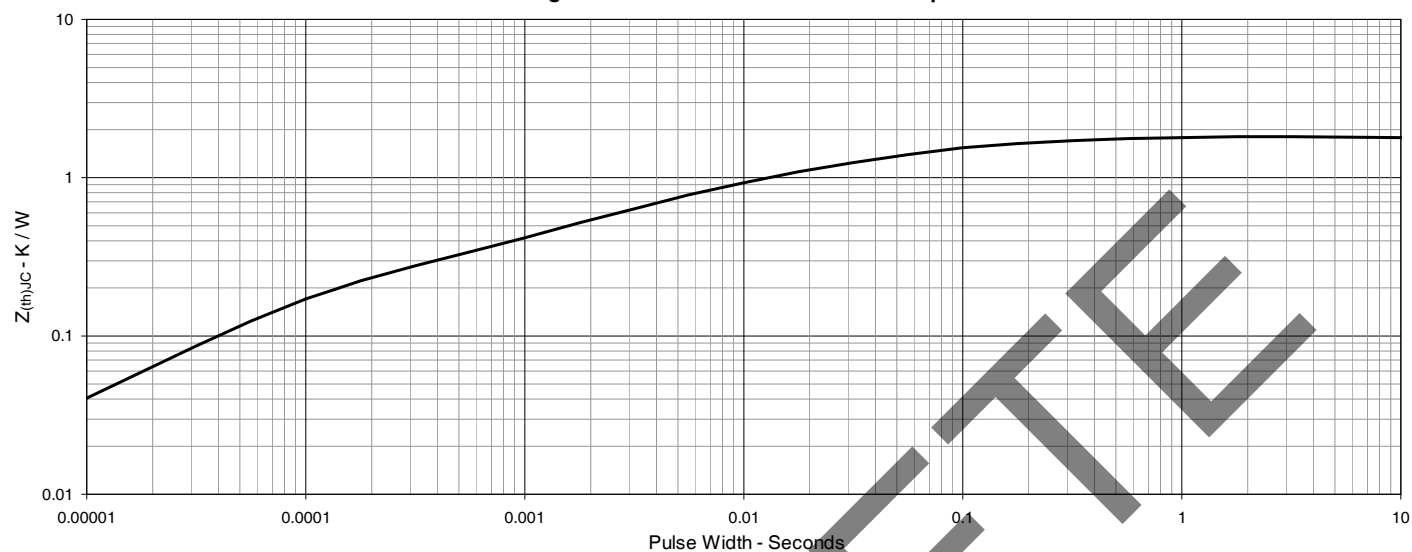
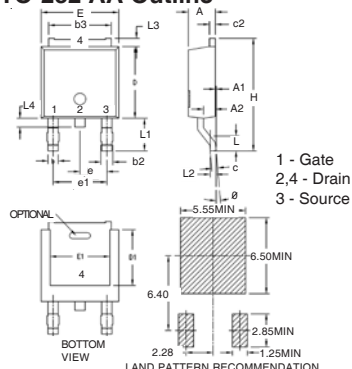


Fig. 13. Maximum Transient Thermal Impedance

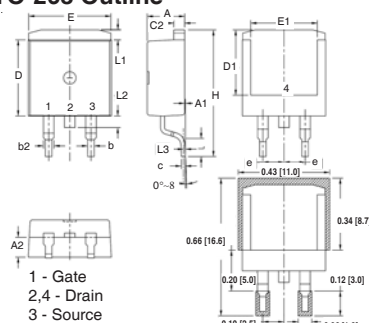


### TO-252 AA Outline



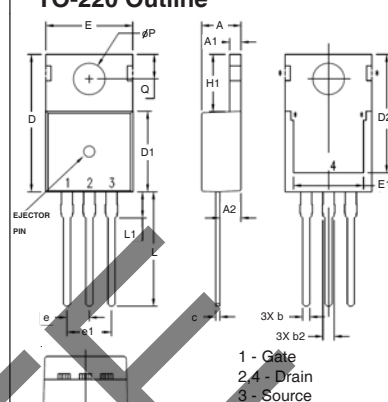
| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .086     | .094 | 2.19        | 2.38  |
| A1  | 0        | .005 | 0           | 0.12  |
| A2  | .038     | .046 | 0.97        | 1.17  |
| b   | .025     | .035 | 0.64        | 0.89  |
| b2  | .030     | .045 | 0.76        | 1.14  |
| b3  | .200     | .215 | 5.08        | 5.46  |
| c   | .018     | .024 | 0.46        | 0.61  |
| c2  | .018     | .023 | 0.46        | 0.58  |
| D   | .235     | .245 | 5.97        | 6.22  |
| D1  | .180     | .205 | 4.57        | 5.21  |
| E   | .250     | .265 | 6.35        | 6.73  |
| E1  | .170     | .205 | 4.32        | 5.21  |
| e   | .090 BSC |      | 2.28 BSC    |       |
| e1  | .180 BSC |      | 4.57 BSC    |       |
| H   | .370     | .410 | 9.40        | 10.42 |
| L   | .055     | .070 | 1.40        | 1.78  |
| L1  | .100     | .115 | 2.54        | 2.92  |
| L2  | .020 BSC |      | 0.50 BSC    |       |
| L3  | .025     | .040 | 0.64        | 1.02  |
| L4  | .025     | .040 | 0.64        | 1.02  |
| θ   | 0°       |      | 10°         |       |

### 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  |       |

### 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  |