International
IOR Rectifier

PD-90712C

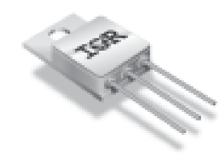
# IRFM360

## POWER MOSFET THRU-HOLE (TO-254AA)

## 400V, N-CHANNEL
### HEXFET® MOSFET TECHNOLOGY

**Product Summary**

| Part Number | $R_{DS(on)}$ | $I_D$ |
|---|---|---|
| IRFM360 | 0.20 Ω | 23A |



TO-254AA

HEXFET® MOSFET technology is the key to International Rectifier's advanced line of power MOSFET transistors. The efficient geometry design achieves very low on-state resistance combined with high transconductance. HEXFET transistors also feature all of the well-established advantages of MOSFETs, such as voltage control, very fast switching, ease of paralleling and electrical parameter temperature stability. They are well-suited for applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers, high energy pulse circuits, and virtually any application where high reliability is required. The HEXFET transistor's totally isolated package eliminates the need for additional isolating material between the device and the heatsink. This improves thermal efficiency and reduces drain capacitance.

**Features:**

- Simple Drive Requirements
- Ease of Paralleling
- Hermetically Sealed
- Electrically Isolated
- Dynamic dv/dt Rating
- Light-weight

## Absolute Maximum Ratings

| | Parameter | | Units |
|---|---|---|---|
| $I_D$ @ $V_{GS}$ = 10V, $T_C$ = 25°C | Continuous Drain Current | 23 | A |
| $I_D$ @ $V_{GS}$ = 10V, $T_C$ = 100°C | Continuous Drain Current | 14 | |
| $I_{DM}$ | Pulsed Drain Current ① | 92 | |
| $P_D$ @ $T_C$ = 25°C | Max. Power Dissipation | 250 | W |
| | Linear Derating Factor | 2.0 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ±20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy ② | 980 | mJ |
| $I_{AR}$ | Avalanche Current ① | 23 | A |
| $E_{AR}$ | Repetitive Avalanche Energy ① | 25 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ③ | 4.0 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction<br>Storage Temperature Range | -55 to 150 | °C |
| | Lead Temperature | 300 ( 0.063 in.(1.6mm) from case for 10s) | |
| | Weight | 9.3 (Typical) | g |

For footnotes refer to the last page



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## Electrical Characteristics @ Tj = 25°C (Unless Otherwise Specified)

| | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-Source Breakdown Voltage | 400 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 1.0mA |
| $\Delta BV_{DSS}/\Delta T_J$ | Temperature Coefficient of Breakdown Voltage | — | 0.46 | — | V/°C | Reference to 25°C, $I_D$ = 1.0mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-State Resistance | — | — | 0.20 | Ω | $V_{GS}$ = 10V, $I_D$ = 14A ④ |
| | | — | — | 0.23 | | $V_{GS}$ = 10V, $I_D$ = 23A |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | — | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA |
| $g_{fs}$ | Forward Transconductance | 1.4 | — | — | | $V_{DS}$ = 15V, $I_{DS}$ = 14A ④ |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | — | — | 25 | μA | $V_{DS}$ = 320V ,$V_{GS}$=0V |
| | | — | — | 250 | | $V_{DS}$ = 320V, $V_{GS}$ = 0V, $T_J$ = 125°C |
| $I_{GSS}$ | Gate-to-Source Leakage Forward | — | — | 100 | nA | $V_{GS}$ = 20V |
| $I_{GSS}$ | Gate-to-Source Leakage Reverse | — | — | -100 | | $V_{GS}$ = -20V |
| $Q_g$ | Total Gate Charge | — | — | 210 | nC | $V_{GS}$ =10V, $I_D$ = 23A |
| $Q_{gs}$ | Gate-to-Source Charge | — | — | 28 | | $V_{DS}$ = 200V |
| $Q_{gd}$ | Gate-to-Drain ('Miller') Charge | — | — | 120 | | |
| $t_{d(on)}$ | Turn-On Delay Time | — | — | 33 | ns | $V_{DD}$ = 200V, $I_D$ = 23A, |
| $t_r$ | Rise Time | — | — | 140 | | $V_{GS}$ =10V, $R_G$ = 2.35Ω |
| $t_{d(off)}$ | Turn-Off Delay Time | — | — | 120 | | |
| $t_f$ | Fall Time | — | — | 99 | | |
| $L_S + L_D$ | Total Inductance | — | 6.8 | — | nH | Measured from drain lead (6mm/ 0.25in. from package) to source lead (6mm/0.25in. from package) |
| $C_{iss}$ | Input Capacitance | — | 4200 | — | pF | $V_{GS}$ = 0V, $V_{DS}$ = 25V |
| $C_{oss}$ | Output Capacitance | — | 900 | — | | f = 1.0MHz |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 400 | — | | |

## Source-Drain Diode Ratings and Characteristics

| | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | — | — | 23 | A | |
| $I_{SM}$ | Pulse Source Current (Body Diode) ① | — | — | 92 | | |
| $V_{SD}$ | Diode Forward Voltage | — | — | 1.8 | V | $T_j$ = 25°C, $I_S$ = 23A, $V_{GS}$ = 0V ④ |
| $t_{rr}$ | Reverse Recovery Time | — | — | 1000 | nS | $T_j$ = 25°C, $I_F$ = 23A, di/dt ≤ 100A/μs |
| $Q_{RR}$ | Reverse Recovery Charge | — | — | 16 | μC | $V_{DD}$ ≤ 50V ④ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by $L_S$ + $L_D$. | | | | |

## Thermal Resistance

| | Parameter | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $R_{thJC}$ | Junction-to-Case | — | — | 0.5 | °C/W | |
| $R_{thCS}$ | Csae-to-sink | — | 0.21 | — | | |
| $R_{thJA}$ | Junction-to-Ambient | — | — | 48 | | Typical socket mount |

**Note: Corresponding Spice and Saber models are available on International Rectifier Website.**

For footnotes refer to the last page



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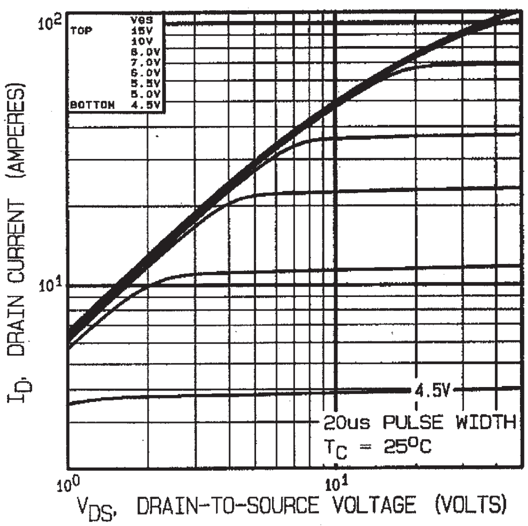


**Fig 1.** Typical Output Characteristics

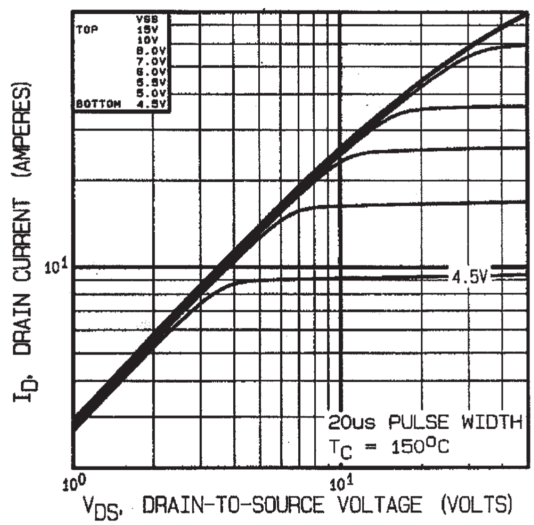


**Fig 2.** Typical Output Characteristics

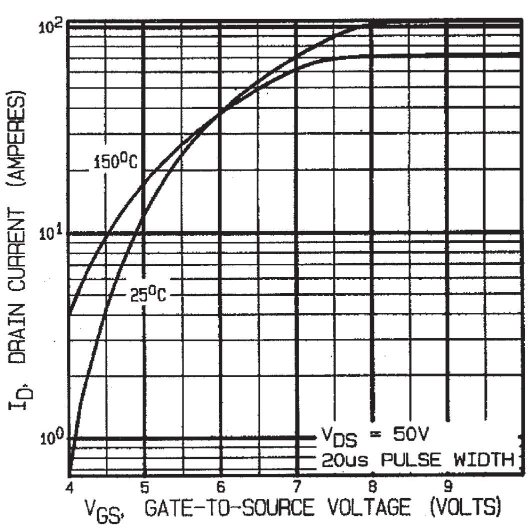


**Fig 3.** Typical Transfer Characteristics

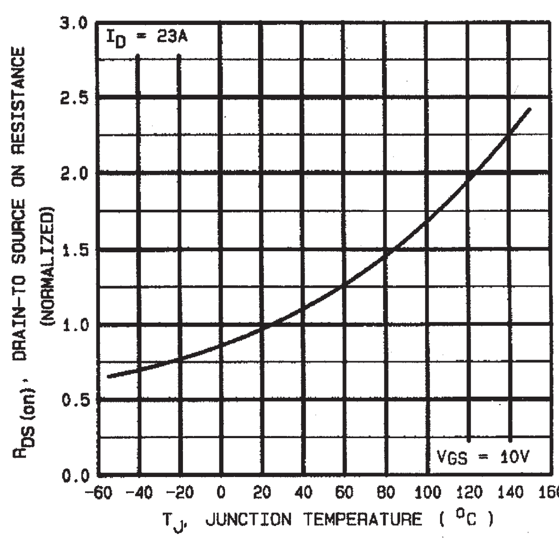


**Fig 4.** Normalized On-Resistance Vs. Temperature



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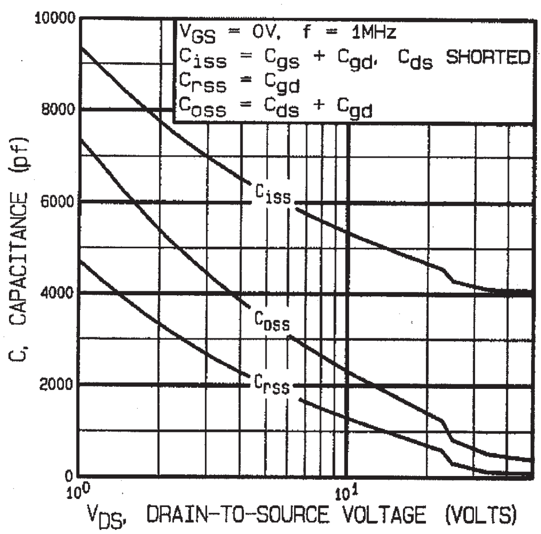


**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage

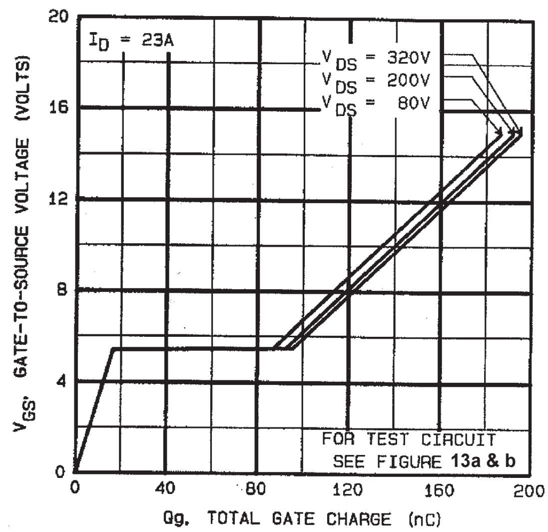


**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage

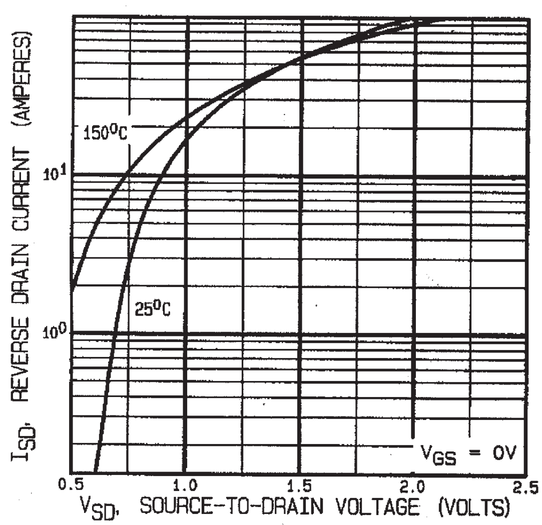


**Fig 7.** Typical Source-Drain Diode Forward Voltage

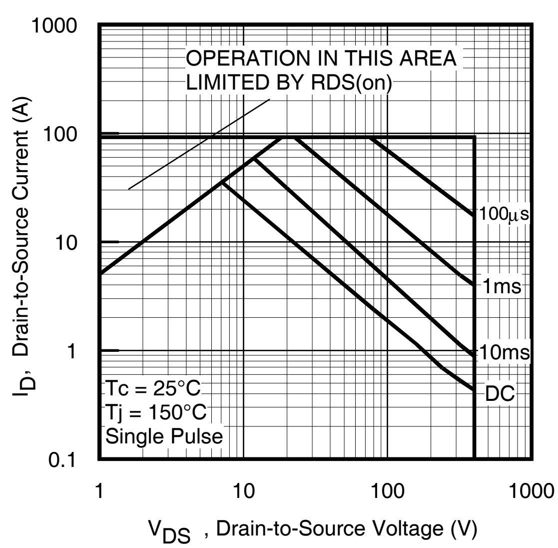


**Fig 8.** Maximum Safe Operating Area



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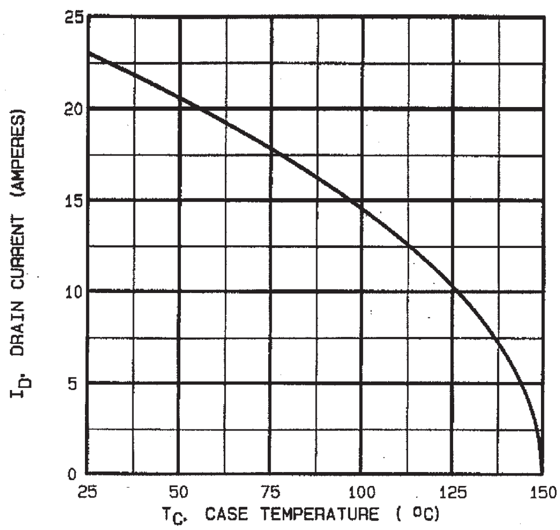


**Fig 9.** Maximum Drain Current Vs. Case Temperature

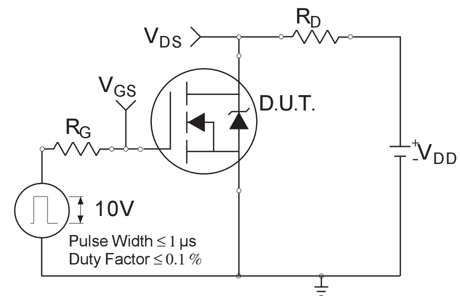


**Fig 10a.** Switching Time Test Circuit

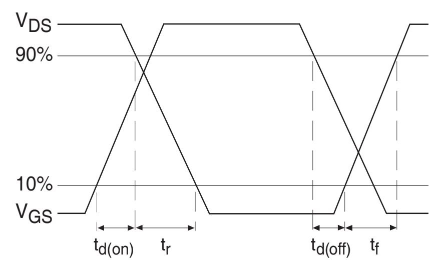


**Fig 10b.** Switching Time Waveforms

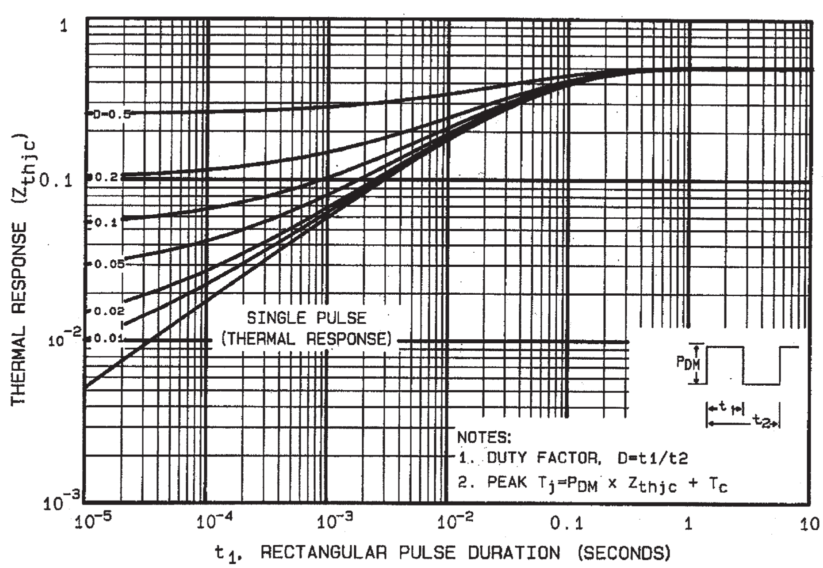


**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



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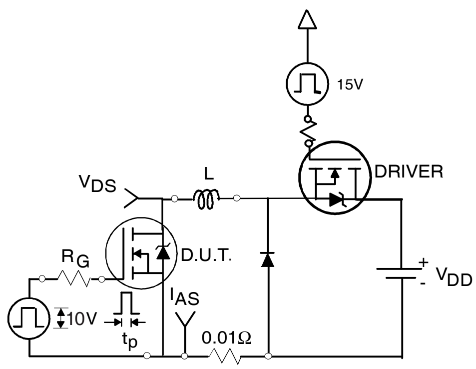


**Fig 12a.** Unclamped Inductive Test Circuit

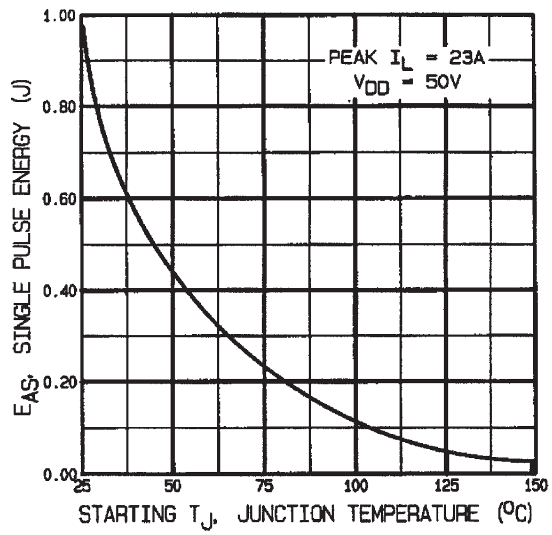


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current

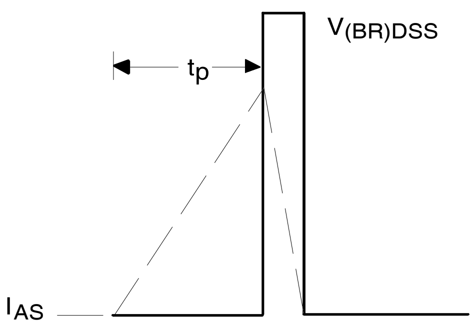


**Fig 12b.** Unclamped Inductive Waveforms

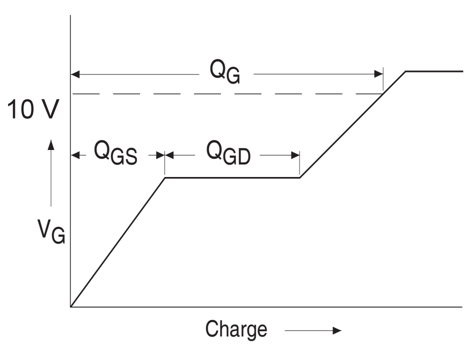


**Fig 13a.** Basic Gate Charge Waveform

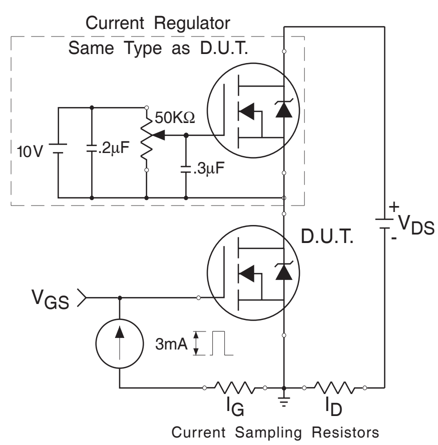


**Fig 13b.** Gate Charge Test Circuit



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## Footnotes:

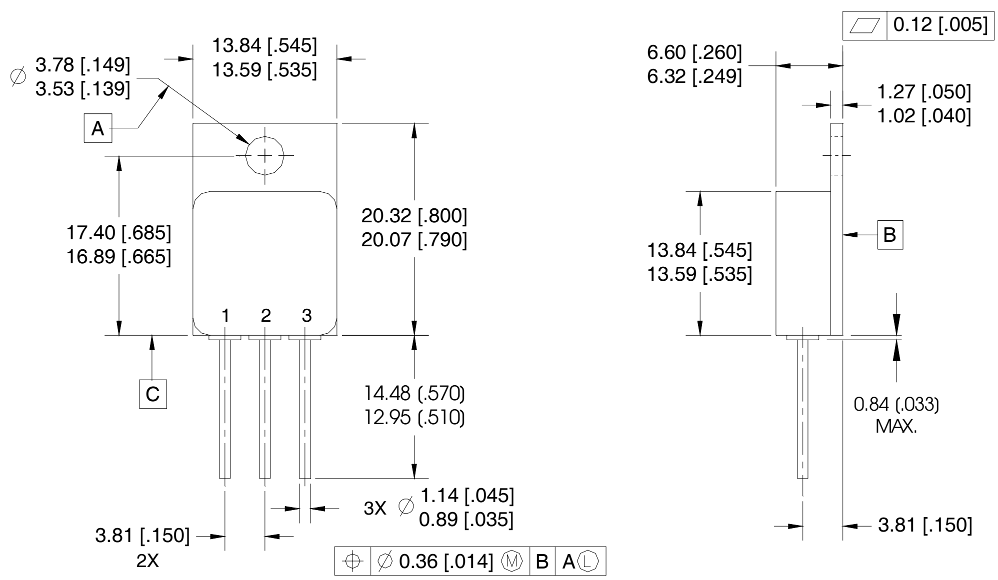
① Repetitive Rating; Pulse width limited by maximum junction temperature.

② $V_{DD}$ = 50V, starting $T_J$ = 25°C, L= 3.7mH Peak $I_L$ = 23A, $V_{GS}$ = 10V

③ $I_{SD} \leq$ 23A, di/dt $\leq$ 170A/µs, $V_{DD} \leq$ 400V, $T_J \leq$ 150°C

④ Pulse width $\leq$ 300 µs; Duty Cycle $\leq$ 2%

## Case Outline and Dimensions — TO-254AA




NOTES:
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. CONTROLLING DIMENSION: INCH.
4. CONFORMS TO JEDEC OUTLINE TO-254AA.

PIN ASSIGNMENTS
1 = DRAIN
2 = SOURCE
3 = GATE

**CAUTION**

**BERYLLIA WARNING PER MIL-PRF-19500**

Package containing beryllia shall not be ground, sandblasted, machined, or have other operations performed on them which will produce beryllia or beryllium dust. Furthermore, beryllium oxide packages shall not be placed in acids that will produce fumes containing beryllium.

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