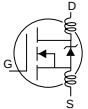


Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)

|                                 | Parameter                            | Min. | Typ.  | Max.  | Units               | Conditions                                           |
|---------------------------------|--------------------------------------|------|-------|-------|---------------------|------------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 55   | —     | —     | V                   | $V_{GS} = 0V, I_D = 250\mu A$                        |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.070 | —     | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$    |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | —     | 0.022 | $\Omega$            | $V_{GS} = 10V, I_D = 25A$ ④                          |
|                                 |                                      | —    | —     | 0.025 |                     | $V_{GS} = 5.0V, I_D = 25A$ ④                         |
|                                 |                                      | —    | —     | 0.035 |                     | $V_{GS} = 4.0V, I_D = 21A$ ④                         |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 1.0  | —     | 2.0   | V                   | $V_{DS} = V_{GS}, I_D = 250\mu A$                    |
| $g_{fs}$                        | Forward Transconductance             | 21   | —     | —     | S                   | $V_{DS} = 25V, I_D = 25A$                            |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —     | 25    | $\mu A$             | $V_{DS} = 55V, V_{GS} = 0V$                          |
|                                 |                                      | —    | —     | 250   |                     | $V_{DS} = 44V, V_{GS} = 0V, T_J = 150^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —     | 100   | nA                  | $V_{GS} = 16V$                                       |
|                                 | Gate-to-Source Reverse Leakage       | —    | —     | -100  |                     | $V_{GS} = -16V$                                      |
| $Q_g$                           | Total Gate Charge                    | —    | —     | 48    | nC                  | $I_D = 25A$                                          |
| $Q_{gs}$                        | Gate-to-Source Charge                | —    | —     | 8.6   |                     | $V_{DS} = 44V$                                       |
| $Q_{gd}$                        | Gate-to-Drain ("Miller") Charge      | —    | —     | 25    |                     | $V_{GS} = 5.0V$ , See Fig. 6 and 13 ④                |
| $t_{d(on)}$                     | Turn-On Delay Time                   | —    | 11    | —     | ns                  | $V_{DD} = 28V$                                       |
| $t_r$                           | Rise Time                            | —    | 84    | —     |                     | $I_D = 25A$                                          |
| $t_{d(off)}$                    | Turn-Off Delay Time                  | —    | 26    | —     |                     | $R_G = 3.4\Omega, V_{GS} = 5.0V$                     |
| $t_f$                           | Fall Time                            | —    | 15    | —     |                     | $R_D = 1.1\Omega$ , See Fig. 10 ④                    |
| $L_D$                           | Internal Drain Inductance            | —    | 4.5   | —     | nH                  | Between lead,<br>6mm (0.25in.)                       |
| $L_S$                           | Internal Source Inductance           | —    | 7.5   | —     |                     | from package<br>and center of die contact            |
| $C_{iss}$                       | Input Capacitance                    | —    | 1700  | —     | pF                  | $V_{GS} = 0V$                                        |
| $C_{oss}$                       | Output Capacitance                   | —    | 400   | —     |                     | $V_{DS} = 25V$                                       |
| $C_{rss}$                       | Reverse Transfer Capacitance         | —    | 150   | —     |                     | $f = 1.0\text{MHz}$ , See Fig. 5                     |



## Source-Drain Ratings and Characteristics

|          | Parameter                              | Min.                                                                        | Typ. | Max. | Units | Conditions                                                     |
|----------|----------------------------------------|-----------------------------------------------------------------------------|------|------|-------|----------------------------------------------------------------|
| $I_S$    | Continuous Source Current (Body Diode) | —                                                                           | —    | 47   | A     | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   | —                                                                           | —    | 160  |       |                                                                |
| $V_{SD}$ | Diode Forward Voltage                  | —                                                                           | —    | 1.3  | V     | $T_J = 25^\circ\text{C}, I_S = 25A, V_{GS} = 0V$ ④             |
| $t_{rr}$ | Reverse Recovery Time                  | —                                                                           | 80   | 120  | ns    | $T_J = 25^\circ\text{C}, I_F = 25A$                            |
| $Q_{rr}$ | Reverse Recovery Charge                | —                                                                           | 210  | 320  | nC    | $di/dt = 100A/\mu s$ ④                                         |
| $t_{on}$ | Forward Turn-On Time                   | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ ) |      |      |       |                                                                |

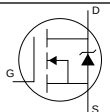
## Notes:

① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )

②  $V_{DD} = 25V$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 470\mu H$   
 $R_G = 25\Omega$ ,  $I_{AS} = 25A$ . (See Figure 12)

③  $I_{SD} \leq 25A$ ,  $di/dt \leq 270A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  
 $T_J \leq 175^\circ\text{C}$

④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .



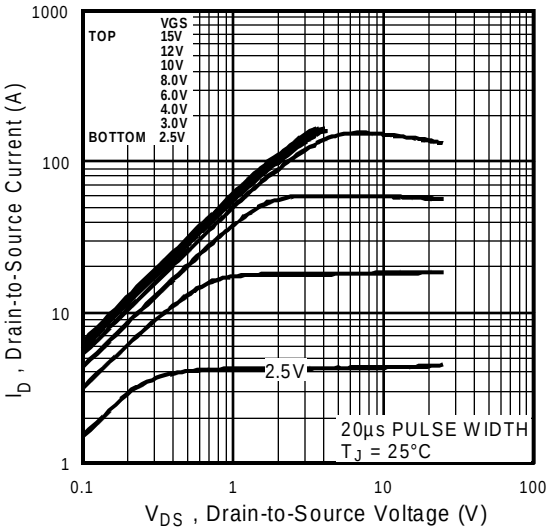


Fig 1. Typical Output Characteristics

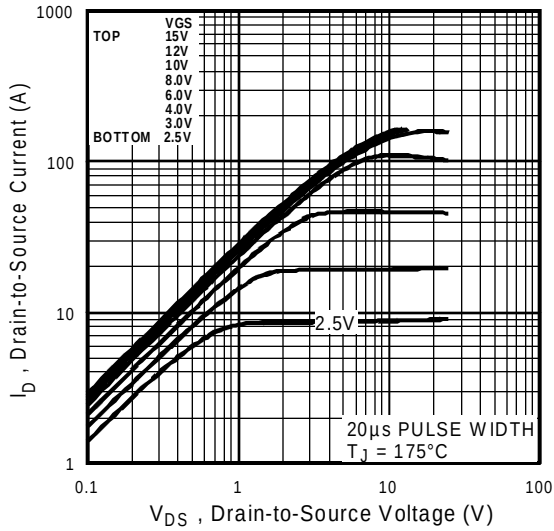


Fig 2. Typical Output Characteristics

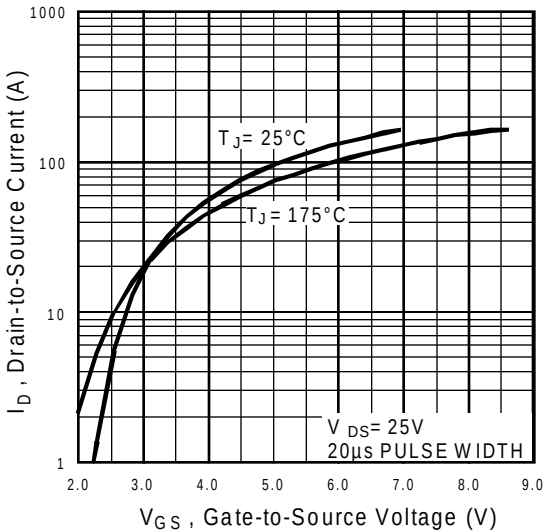


Fig 3. Typical Transfer Characteristics

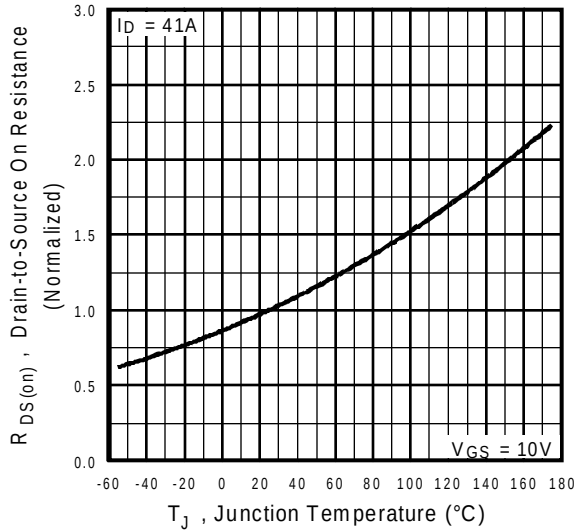
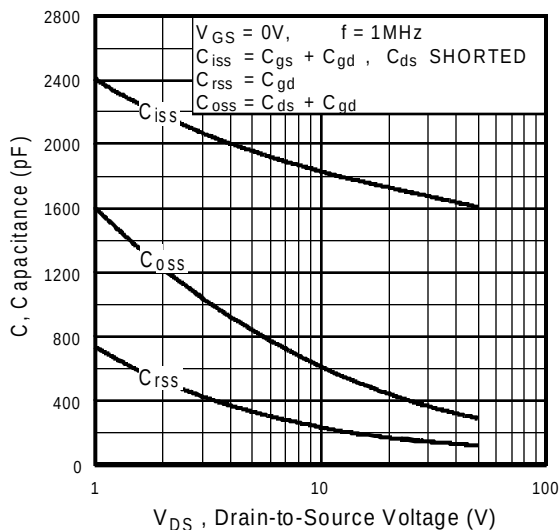
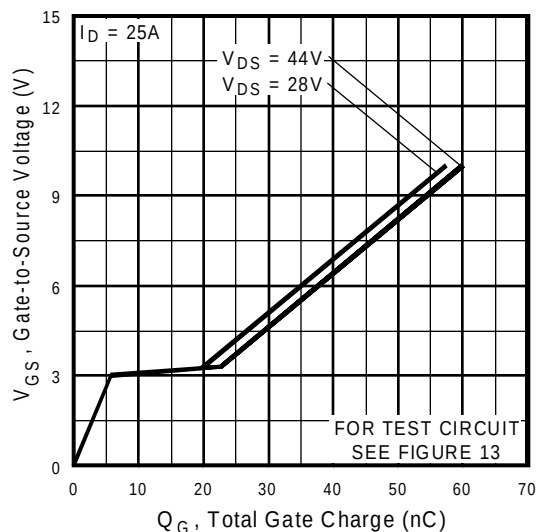


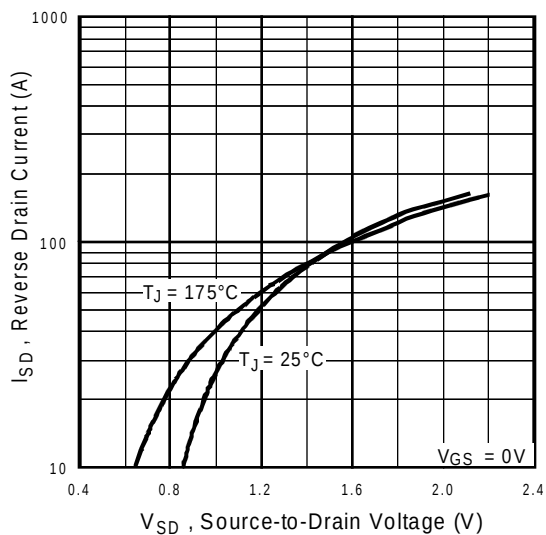
Fig 4. Normalized On-Resistance Vs. Temperature



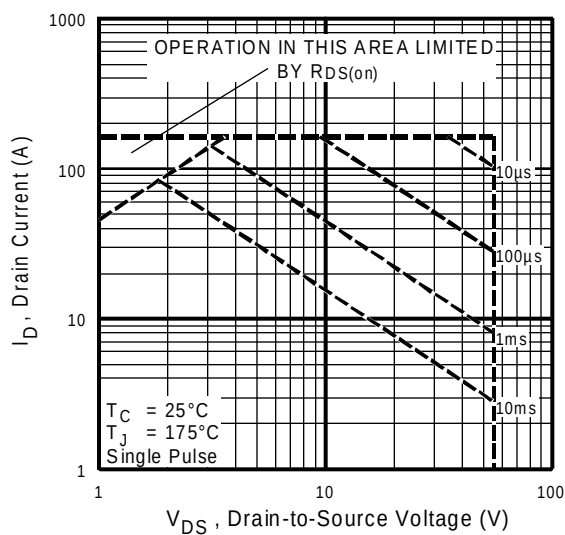
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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



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



**Fig 8.** Maximum Safe Operating Area

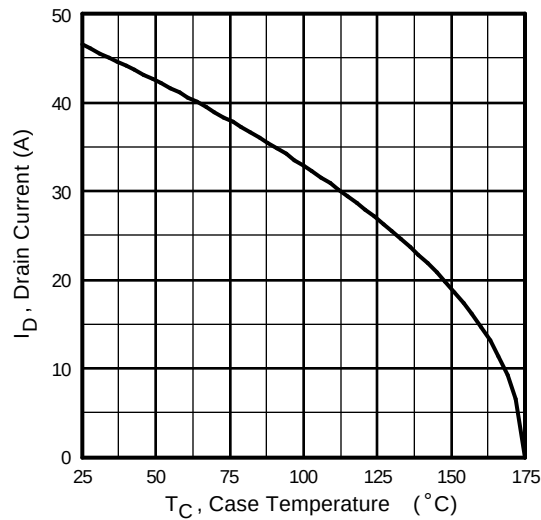


Fig 9. Maximum Drain Current Vs. Case Temperature

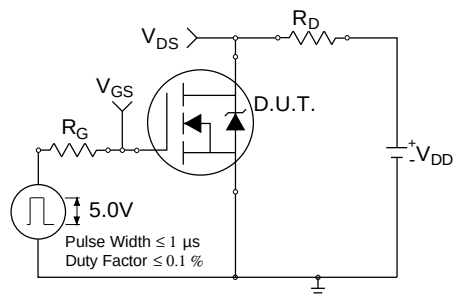


Fig 10a. Switching Time Test Circuit

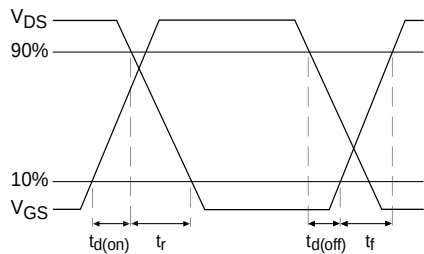


Fig 10b. Switching Time Waveforms

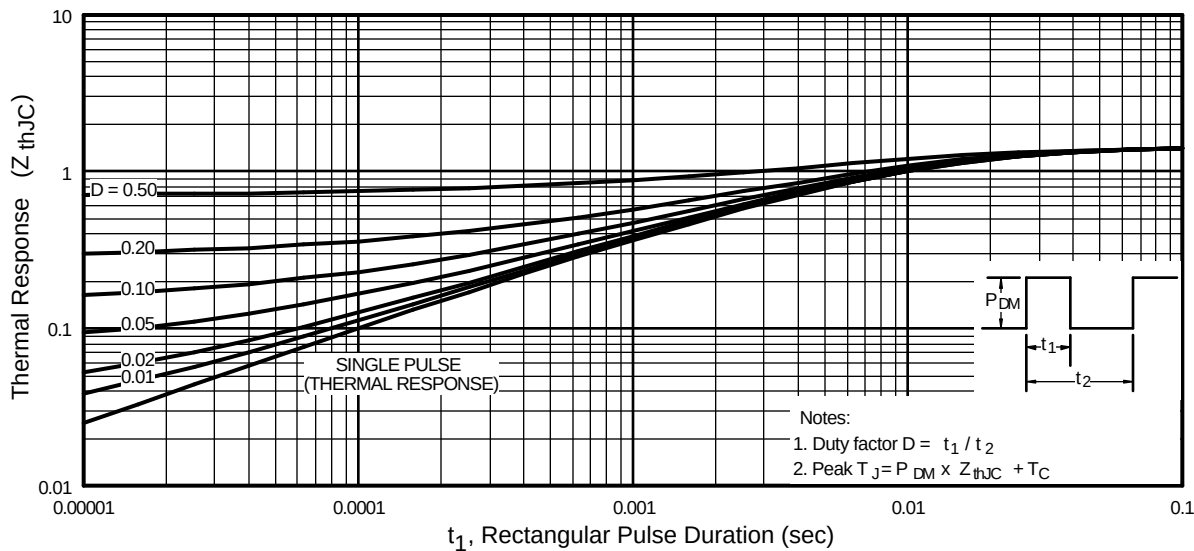
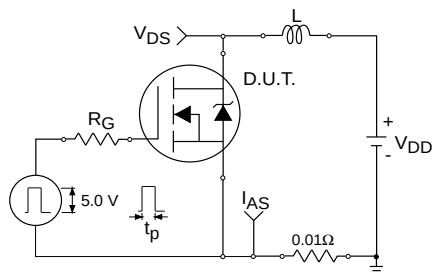
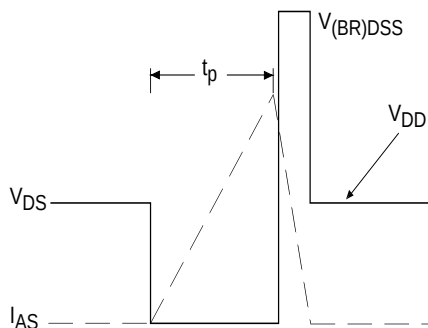


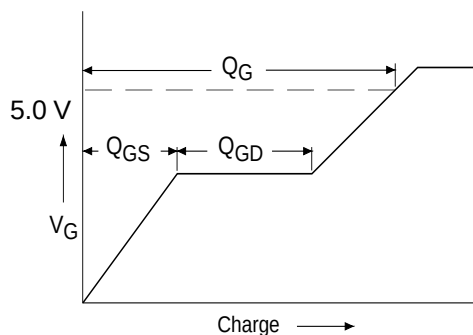
Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case



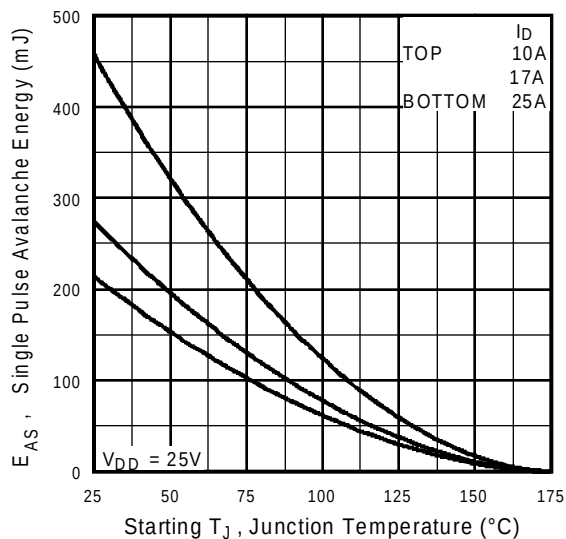
**Fig 12a.** Unclamped Inductive Test Circuit



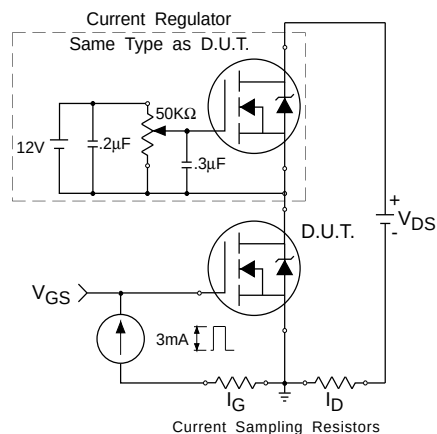
**Fig 12b.** Unclamped Inductive Waveforms



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

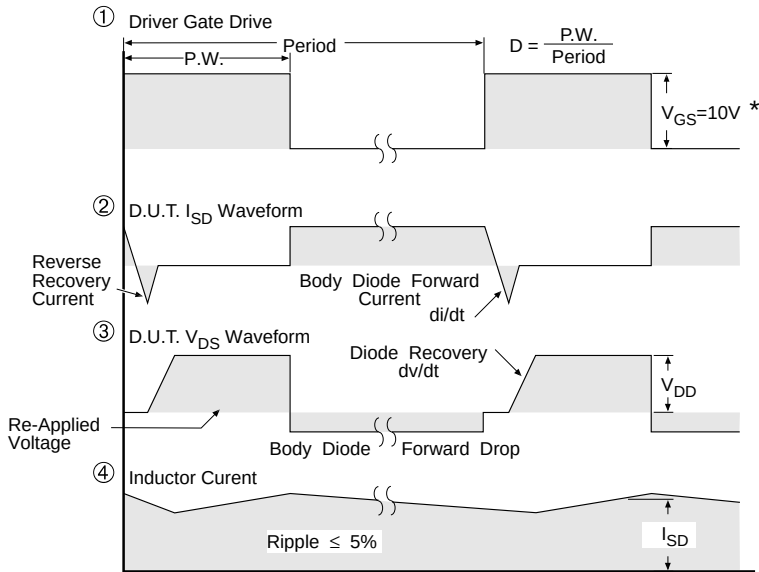
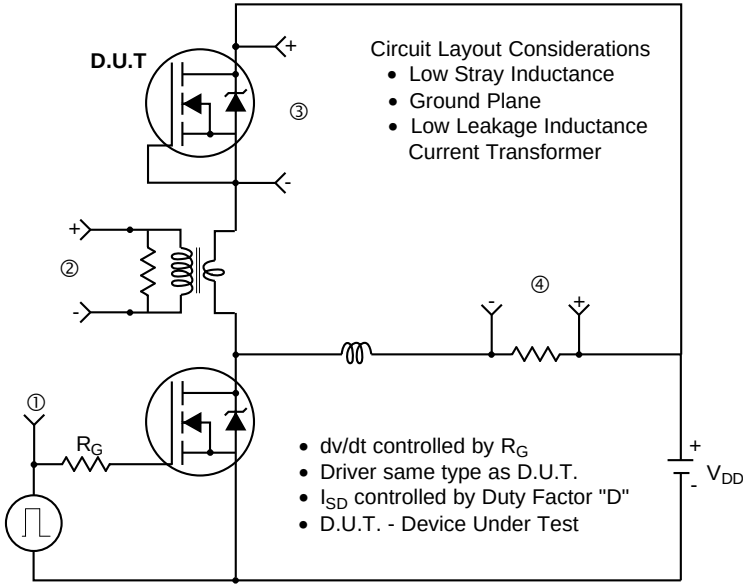


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



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

Peak Diode Recovery dv/dt Test Circuit



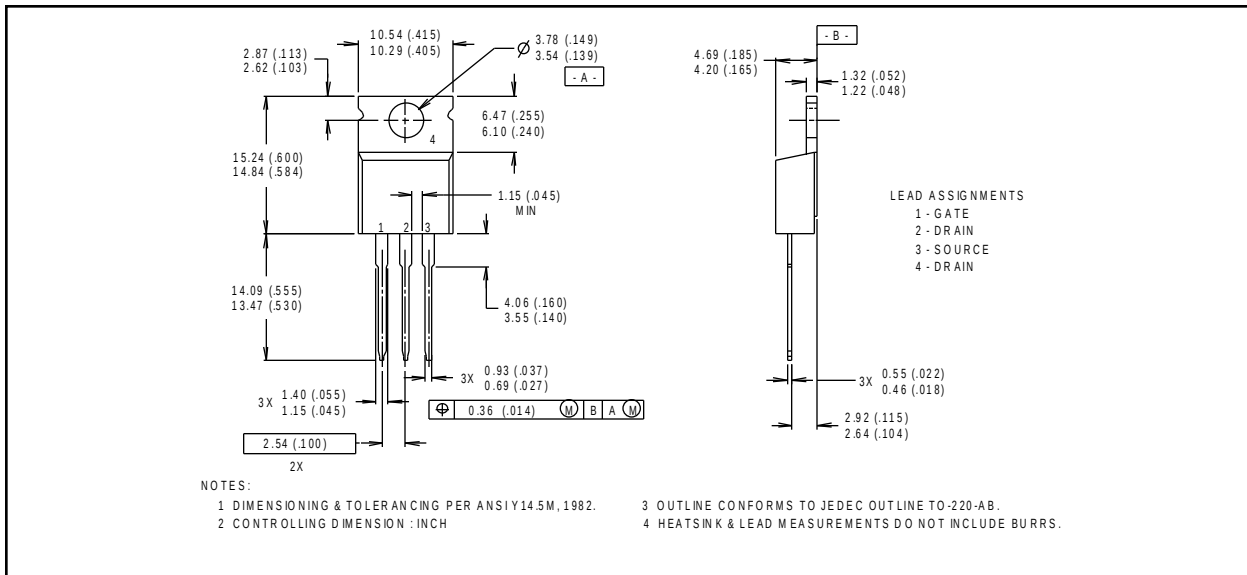
\* V<sub>GS</sub> = 5V for Logic Level Devices

Fig 14. For N-Channel HEXFETS

## Package Outline

### TO-220AB Outline

Dimensions are shown in millimeters (inches)



## Part Marking Information

### TO-220AB

EXAMPLE : THIS IS AN IRF1010  
 WITH ASSEMBLY  
 LOT CODE 9B1M

