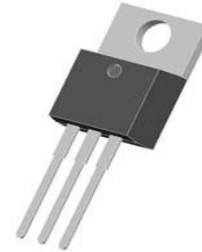


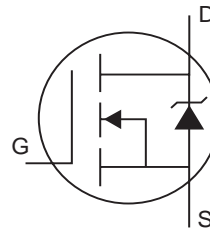
TO-220AB

- Advanced Process Technology
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated



## Description

The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.



$$V_{DSS} = 55V$$

$$R_{DS(on)} = 0.07\Omega$$

$$I_D = 17A$$

## Absolute Maximum Ratings

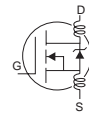
	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	17	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	12	
$I_{DM}$	Pulsed Drain Current ①	68	
$P_D @ T_C = 25^\circ C$	Power Dissipation	45	W
	Linear Derating Factor	0.30	W/°C
$V_{GS}$	Gate-to-Source Voltage	±20	V
$E_{AS}$	Single Pulse Avalanche Energy ②	71	mJ
$I_{AR}$	Avalanche Current ①	10	A
$E_{AR}$	Repetitive Avalanche Energy ①	4.5	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
$T_J$	Operating Junction and	-55 to + 175	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw.	10 lbf•in (1.1N•m)	

## Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	3.3	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	—	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	—	62	

## 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	—	0.052	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.07	$\Omega$	$V_{GS} = 10V, I_D = 10A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Transconductance	4.5	—	—	S	$V_{DS} = 25V, I_D = 10A$
$I_{DSS}$	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	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
$Q_g$	Total Gate Charge	—	—	20	nC	$I_D = 10A$
$Q_{gs}$	Gate-to-Source Charge	—	—	5.3		$V_{DS} = 44V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	7.6		$V_{GS} = 10V$ , See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	4.9	—		$V_{DD} = 28V$
$t_r$	Rise Time	—	34	—	ns	$I_D = 10A$
$t_{d(off)}$	Turn-Off Delay Time	—	19	—		$R_G = 24\Omega$
$t_f$	Fall Time	—	27	—		$R_D = 2.6\Omega$ , See Fig. 10 ④
$L_D$	Internal Drain Inductance	—	4.5	—		nH
$L_S$	Internal Source Inductance	—	7.5	—		
$C_{iss}$	Input Capacitance	—	370	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	140	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	65	—		$f = 1.0\text{MHz}$ , See Fig. 5



## Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	17	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	68		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 10A, V_{GS} = 0V$ ②
$t_{rr}$	Reverse Recovery Time	—	56	83	ns	$T_J = 25^\circ\text{C}, I_F = 10A$
$Q_{rr}$	Reverse Recovery Charge	—	120	180	nC	$di/dt = 100A/\mu s$ ④

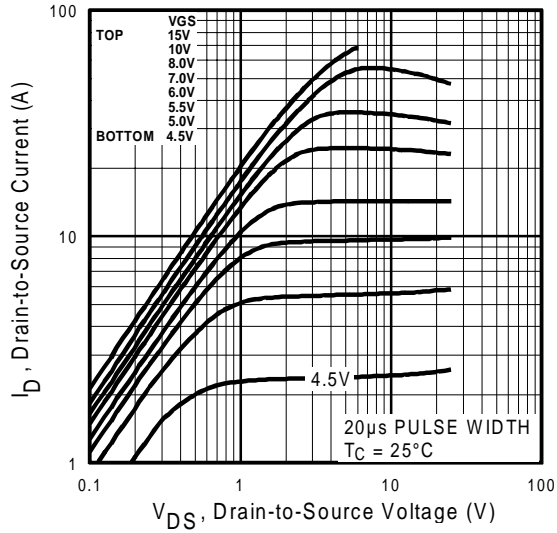
### Notes:

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

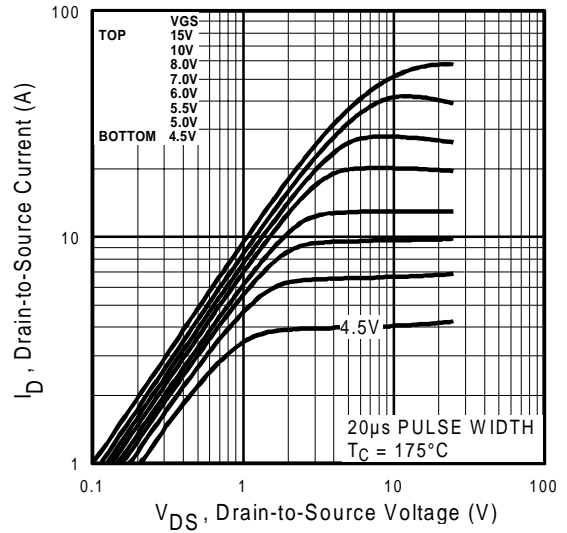
②  $V_{DD} = 25V$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 1.0\text{mH}$   
 $R_G = 25\Omega, I_{AS} = 10A$ . (See Figure 12)

③  $I_{SD} \leq 10A, di/dt \leq 280A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 175^\circ\text{C}$

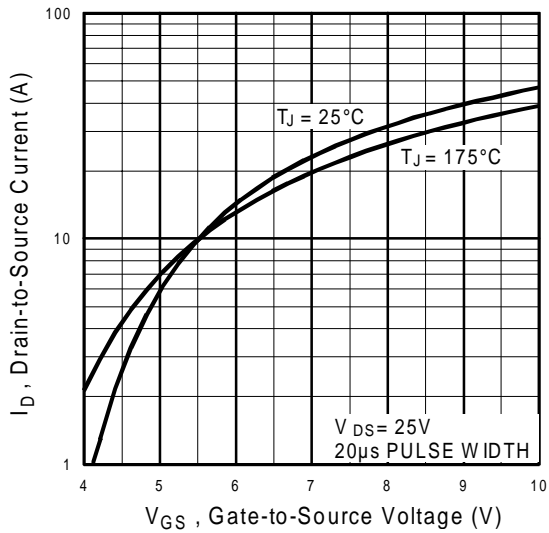
④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .



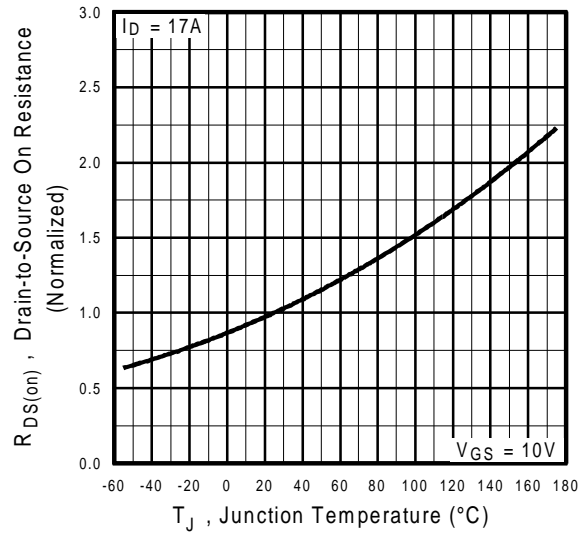
**Fig 1.** Typical Output Characteristics,  
 $T_J = 25^\circ\text{C}$



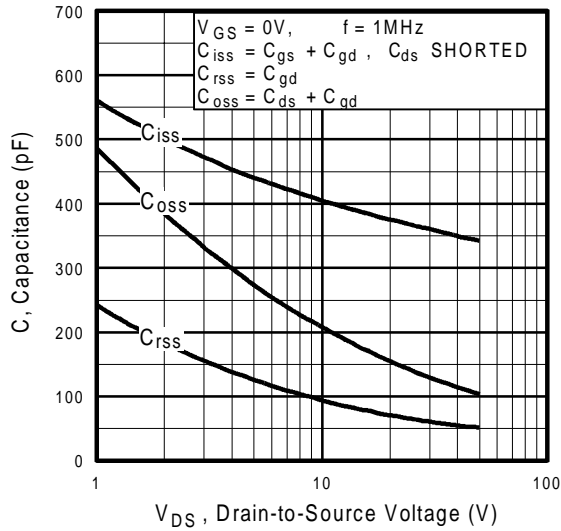
**Fig 2.** Typical Output Characteristics,  
 $T_J = 175^\circ\text{C}$



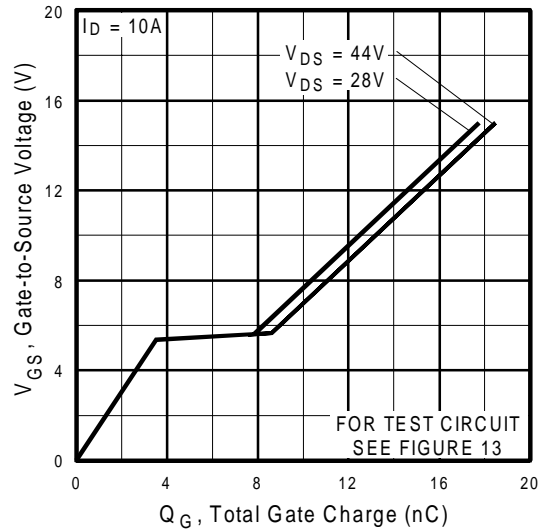
**Fig 3.** Typical Transfer Characteristics



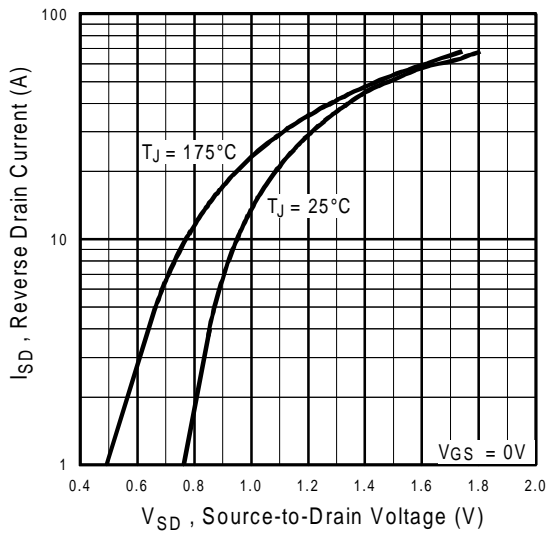
**Fig 4.** Normalized On-Resistance  
Vs. Temperature



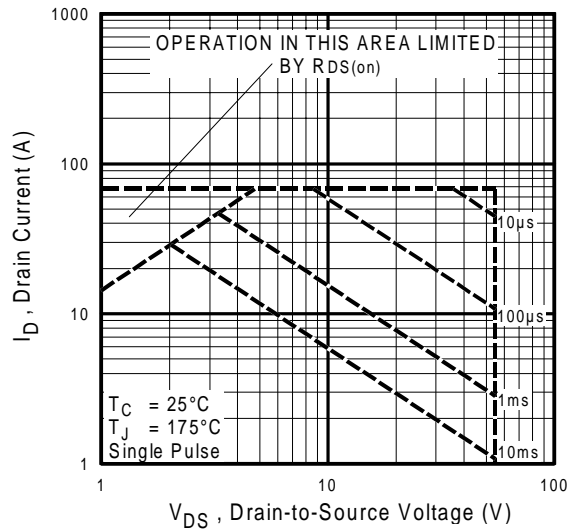
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



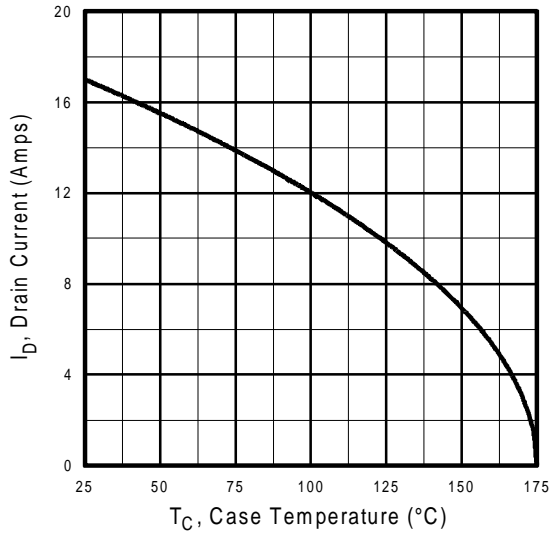
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



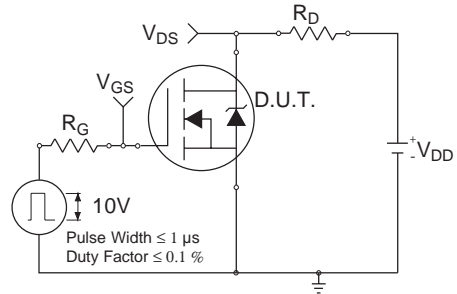
**Fig 7.** Typical Source-Drain Diode Forward Voltage



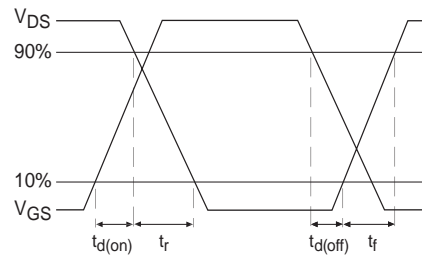
**Fig 8.** Maximum Safe Operating Area



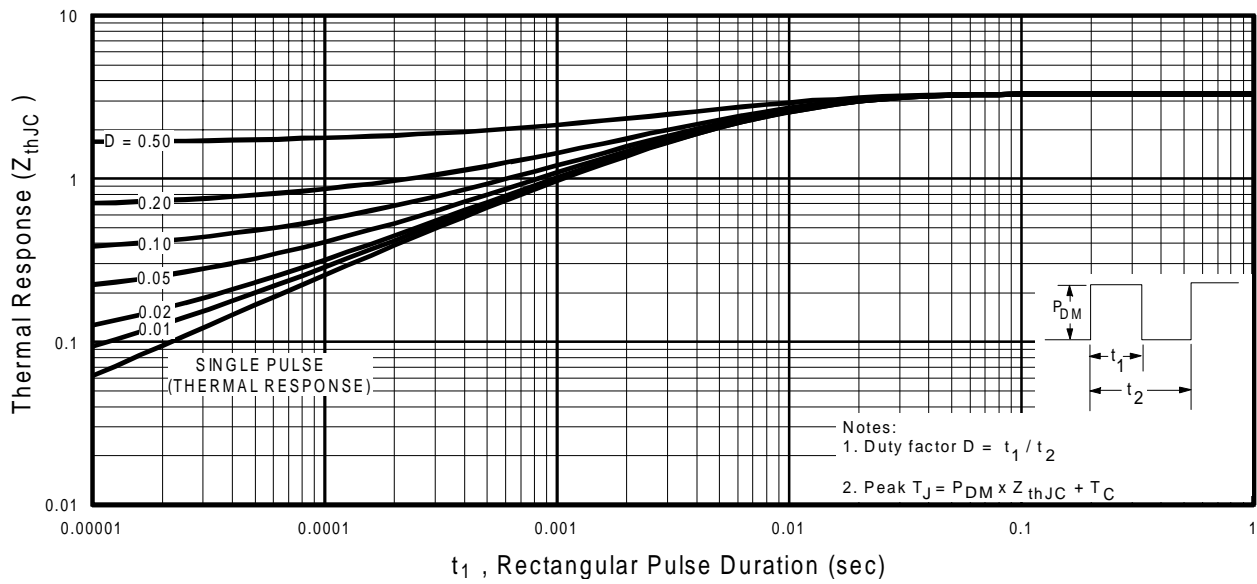
**Fig 9.** Maximum Drain Current Vs. Case Temperature

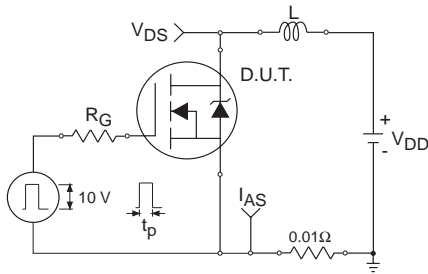


**Fig 10a.** Switching Time Test Circuit

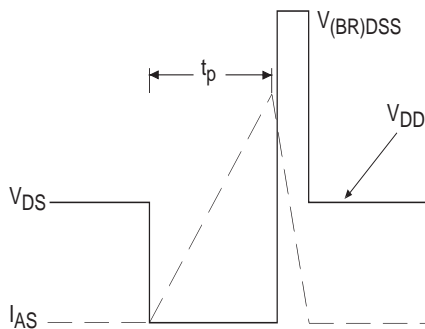


**Fig 10b.** Switching Time Waveforms

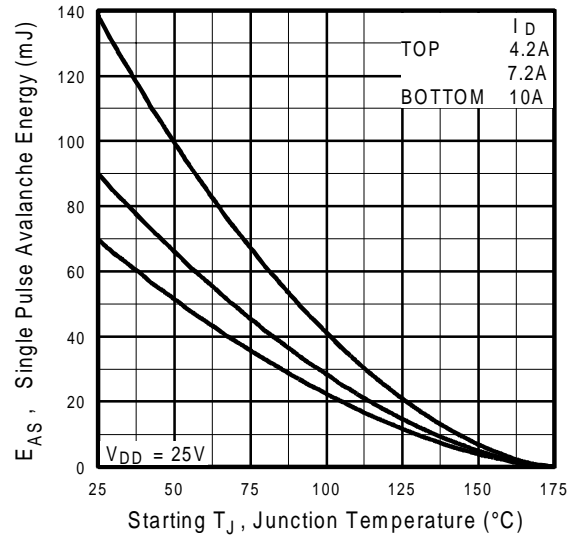




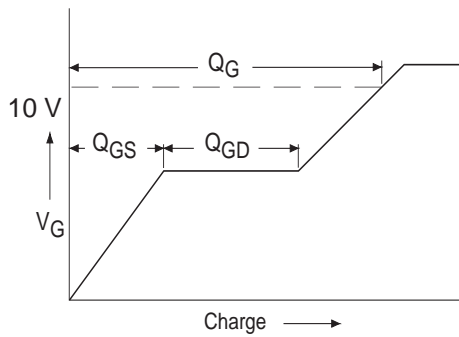
**Fig 12a.** Unclamped Inductive Test Circuit



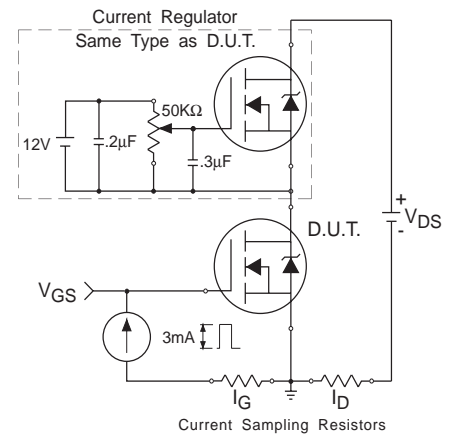
**Fig 12b.** Unclamped Inductive Waveforms



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

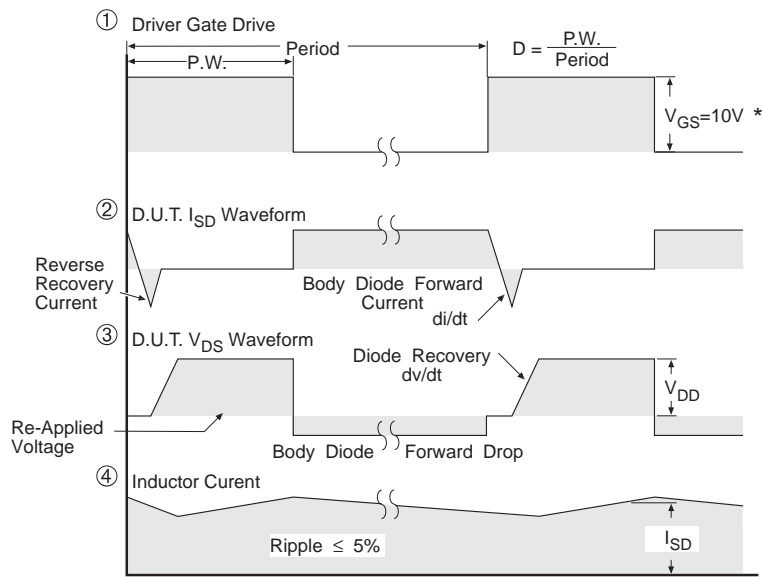


**Fig 13a.** Basic Gate Charge Waveform



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

## Peak Diode Recovery dv/dt Test Circuit



\*  $V_{GS} = 5V$  for Logic Level Devices

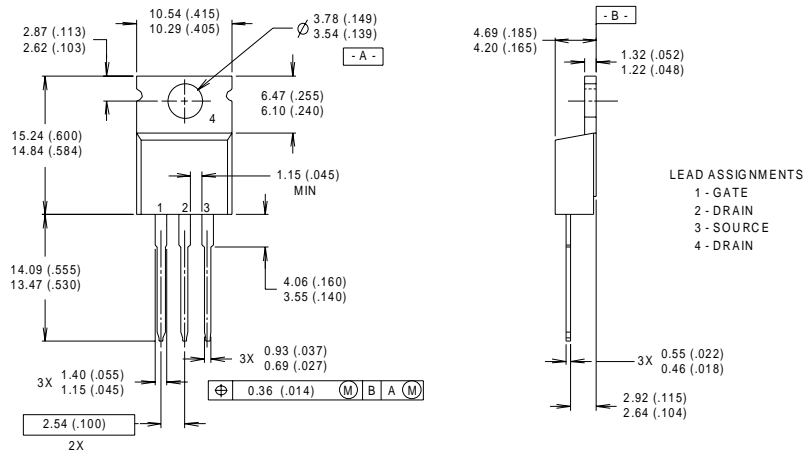


# IRFZ24N

## Package Outline

### TO-220AB

Dimensions are shown in millimeters (inches)



- NOTES:
- 1 DIMENSIONING & TOLERANCING PER ANSII Y14.5M, 1982.
  - 2 CONTROLLING DIMENSION : INCH
  - 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220-AB.
  - 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

## Part Marking Information

### TO-220AB

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

