

International  
**IR** Rectifier

PD- 91889A

**SMPS MOSFET** **IRFBC30A**  
HEXFET® Power MOSFET

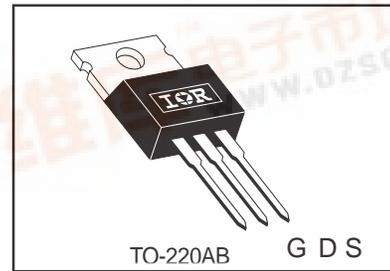
**Applications**

- Switch Mode Power Supply (SMPS)
- Uninterruptable Power Supply
- High speed power switching

| $V_{DSS}$ | Rds(on) max | $I_D$ |
|-----------|-------------|-------|
| 600V      | 2.2Ω        | 3.6A  |

**Benefits**

- Low Gate Charge Qg results in Simple Drive Requirement
- Improved Gate, Avalanche and dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Effective Coss specified (See AN 1001)



**Absolute Maximum Ratings**

|                                 | Parameter                                       | Max.                   | Units |
|---------------------------------|---|------------------------|-------|
| $I_D @ T_C = 25^\circ\text{C}$  | Continuous Drain Current, $V_{GS} @ 10\text{V}$ | 3.6                    | A     |
| $I_D @ T_C = 100^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10\text{V}$ | 2.3                    |       |
| $I_{DM}$                        | Pulsed Drain Current ①                          | 14                     |       |
| $P_D @ T_C = 25^\circ\text{C}$  | Power Dissipation                               | 74                     | W     |
|                                 | Linear Derating Factor                          | 0.69                   | W/°C  |
| $V_{GS}$                        | Gate-to-Source Voltage                          | ± 30                   | V     |
| dv/dt                           | Peak Diode Recovery dv/dt ③                     | 7.0                    | V/ns  |
| $T_J$                           | Operating Junction and                          | -55 to + 150           | °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)     |       |

**Typical SMPS Topology:**

- Single transistor Flyback

Notes ① through ⑤ are on page 8

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

|                                 | Parameter                            | Min. | Typ. | Max. | Units               | Conditions  |
|---------------------------------|--------------------------------------|------|------|------|---------------------|---|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 600  | —    | —    | V                   | $V_{GS} = 0V, I_D = 250\mu A$                         |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.67 | —    | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ ⑥   |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | —    | 2.2  | $\Omega$            | $V_{GS} = 10V, I_D = 2.2A$ ④                          |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 2.0  | —    | 4.5  | V                   | $V_{DS} = V_{GS}, I_D = 250\mu A$                     |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —    | 25   | $\mu A$             | $V_{DS} = 600V, V_{GS} = 0V$                          |
|                                 |                                      | —    | —    | 250  |                     | $V_{DS} = 480V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —    | 100  | nA                  | $V_{GS} = 30V$  |
|                                 | Gate-to-Source Reverse Leakage       | —    | —    | -100 |                     | $V_{GS} = -30V$                                       |

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

|                 | Parameter                       | Min. | Typ. | Max. | Units | Conditions  |
|-----------------|---------------------------------|------|------|------|-------|---|
| $g_{fs}$        | Forward Transconductance        | 2.1  | —    | —    | S     | $V_{DS} = 50V, I_D = 2.2A$  |
| $Q_g$           | Total Gate Charge               | —    | —    | 23   | nC    | $I_D = 3.6A$<br>$V_{DS} = 480V$<br>$V_{GS} = 10V$ , See Fig. 6 and 13 ④   |
| $Q_{gs}$        | Gate-to-Source Charge           | —    | —    | 5.4  |       |   |
| $Q_{gd}$        | Gate-to-Drain ("Miller") Charge | —    | —    | 11   |       |   |
| $t_{d(on)}$     | Turn-On Delay Time              | —    | 9.8  | —    | ns    | $V_{DD} = 300V$<br>$I_D = 3.6A$<br>$R_G = 12\Omega$<br>$R_D = 82\Omega$ , See Fig. 10 ④   |
| $t_r$           | Rise Time                       | —    | 13   | —    |       |   |
| $t_{d(off)}$    | Turn-Off Delay Time             | —    | 19   | —    |       |   |
| $t_f$           | Fall Time                       | —    | 12   | —    |       |   |
| $C_{iss}$       | Input Capacitance               | —    | 510  | —    | pF    | $V_{GS} = 0V$<br>$V_{DS} = 25V$<br>$f = 1.0\text{MHz}$ , See Fig. 5<br>$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$<br>$V_{GS} = 0V, V_{DS} = 480V, f = 1.0\text{MHz}$<br>$V_{GS} = 0V, V_{DS} = 0V$ to $480V$ ⑤ |
| $C_{oss}$       | Output Capacitance              | —    | 70   | —    |       |   |
| $C_{riss}$      | Reverse Transfer Capacitance    | —    | 3.5  | —    |       |   |
| $C_{oss}$       | Output Capacitance              | —    | 730  | —    |       |   |
| $C_{oss}$       | Output Capacitance              | —    | 19   | —    |       |   |
| $C_{oss\ eff.}$ | Effective Output Capacitance    | —    | 31   | —    |       |   |

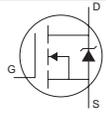
## Avalanche Characteristics

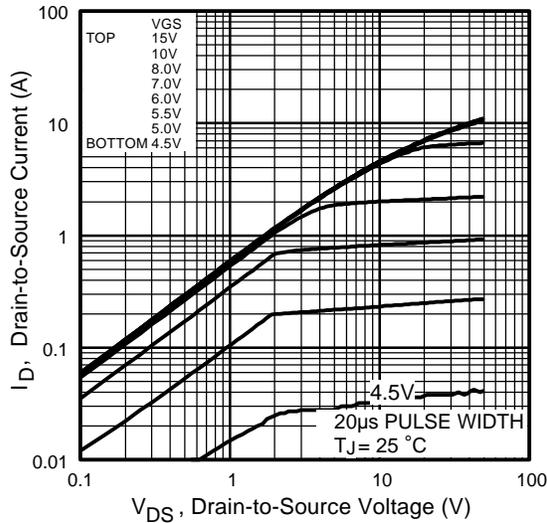
|          | Parameter                      | Typ. | Max. | Units |
|----------|--------------------------------|------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy② | —    | 290  | mJ    |
| $I_{AR}$ | Avalanche Current①             | —    | 3.6  | A     |
| $E_{AR}$ | Repetitive Avalanche Energy①   | —    | 7.4  | mJ    |

## Thermal Resistance

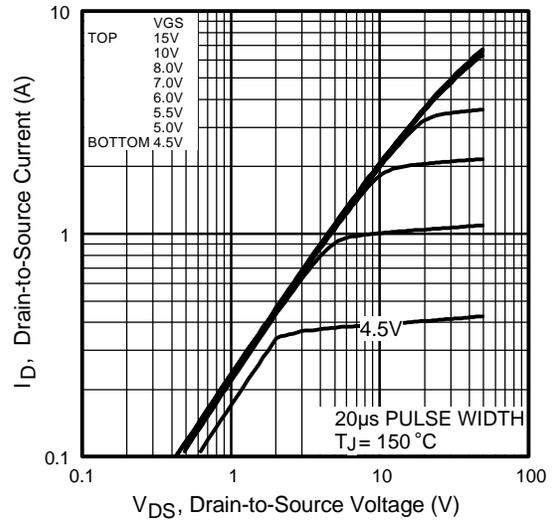
|                 | Parameter                           | Typ. | Max. | Units              |
|-----------------|-------------------------------------|------|------|--------------------|
| $R_{\theta JC}$ | Junction-to-Case                    | —    | 1.7  | $^\circ\text{C/W}$ |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.50 | —    |                    |
| $R_{\theta JA}$ | Junction-to-Ambient                 | —    | 62   |                    |

## Diode Characteristics

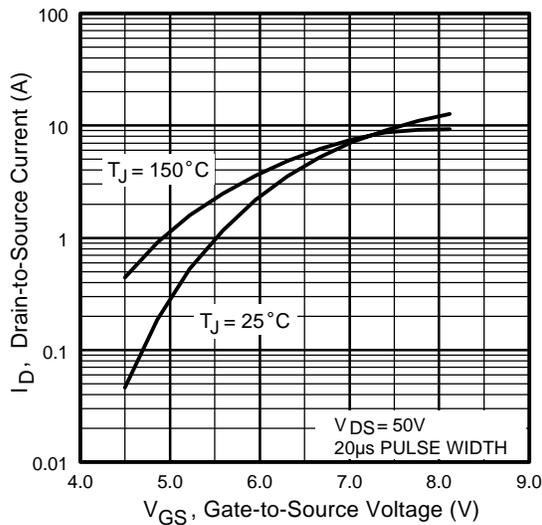
|          | Parameter                              | Min.  | Typ. | Max. | Units   | Conditions   |
|----------|--|---|------|------|---------|--|
| $I_S$    | Continuous Source Current (Body Diode) | —   | —    | 3.6  | A       | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   | —   | —    | 14   |         |  |
| $V_{SD}$ | Diode Forward Voltage                  | —   | —    | 1.6  | V       | $T_J = 25^\circ\text{C}, I_S = 3.6A, V_{GS} = 0V$ ④  |
| $t_{rr}$ | Reverse Recovery Time                  | —   | 400  | 600  | ns      | $T_J = 25^\circ\text{C}, I_F = 3.6A$   |
| $Q_{rr}$ | Reverse Recovery Charge                | —   | 1.1  | 1.7  | $\mu C$ | $di/dt = 100A/\mu s$ ④   |
| $t_{on}$ | Forward Turn-On Time                   | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ ) |      |      |         |  |



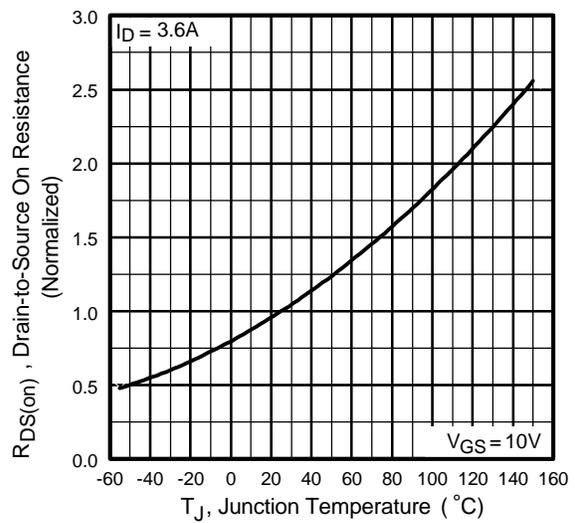
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



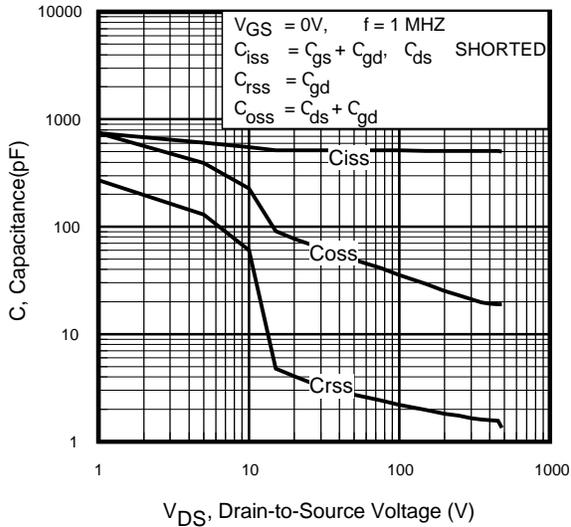
**Fig 3.** Typical Transfer Characteristics



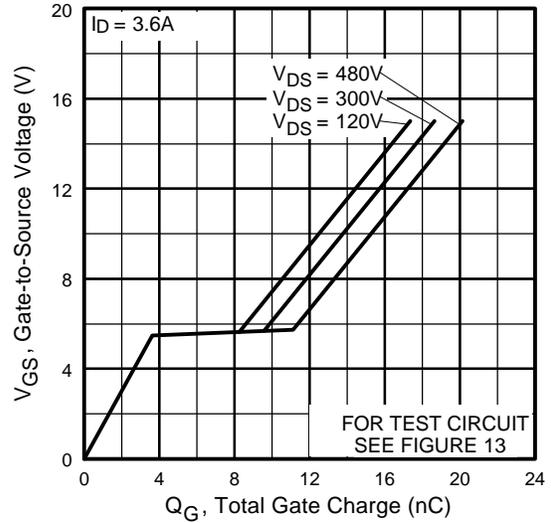
**Fig 4.** Normalized On-Resistance Vs. Temperature

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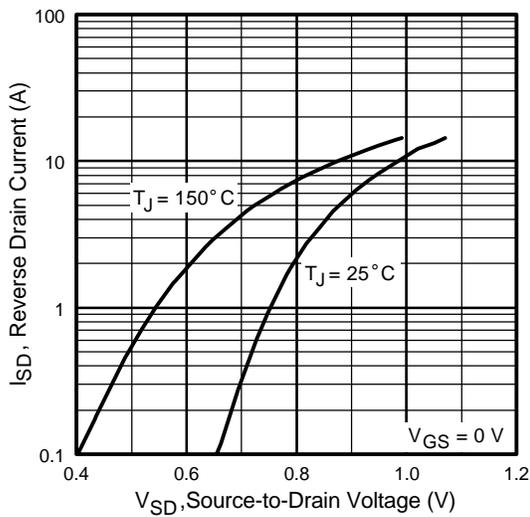
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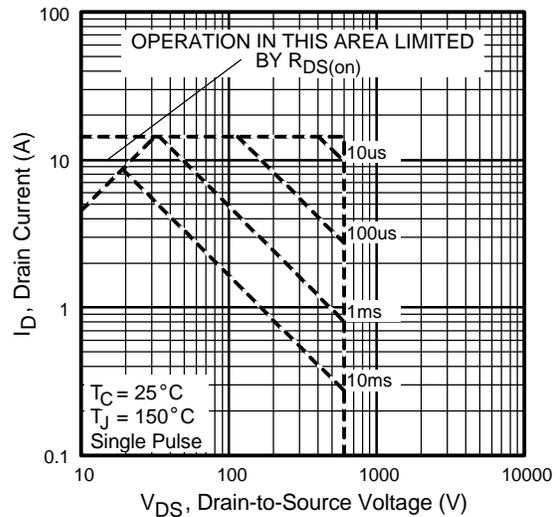
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



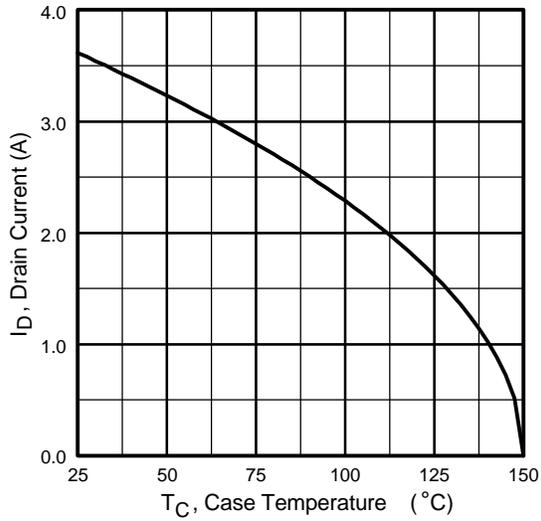
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



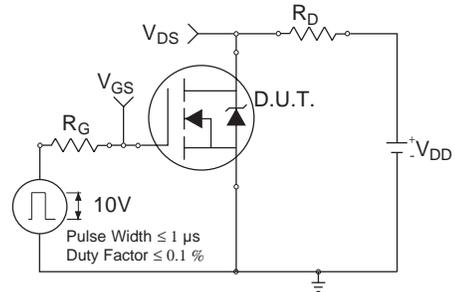
**Fig 7.** Typical Source-Drain Diode Forward Voltage



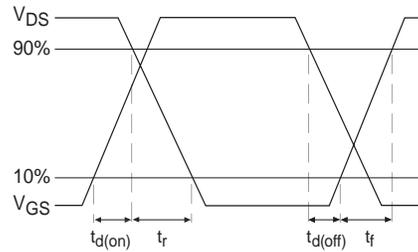
**Fig 8.** Maximum Safe Operating Area



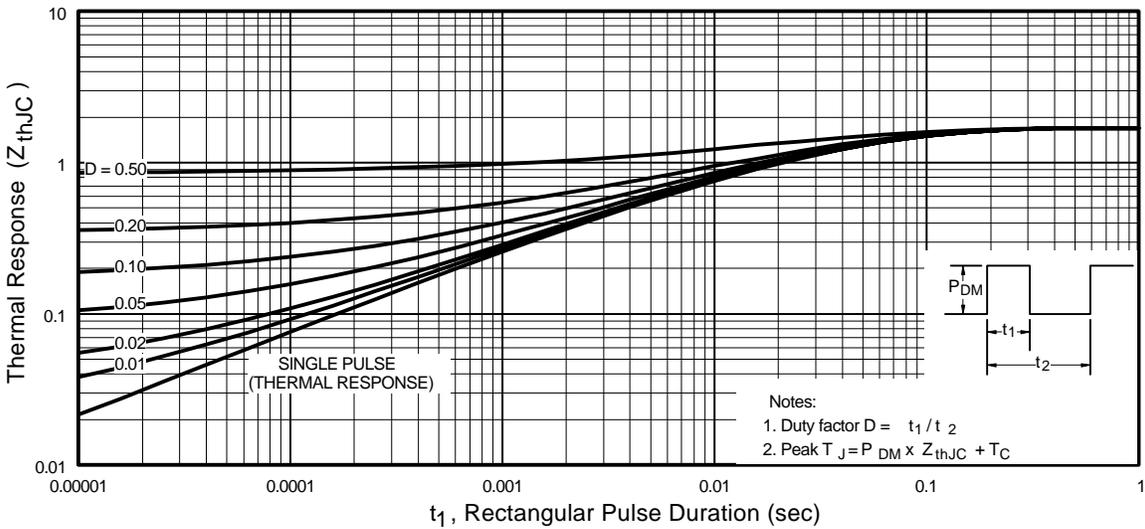
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



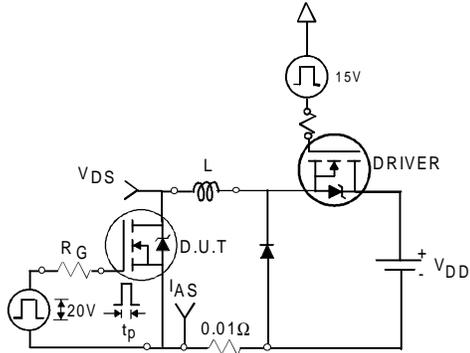
**Fig 10b.** Switching Time Waveforms



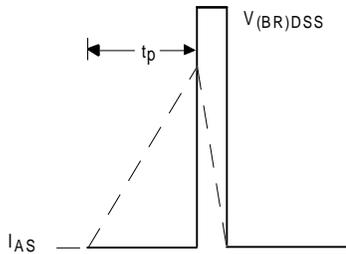
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

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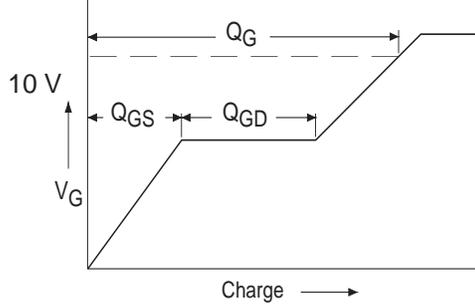
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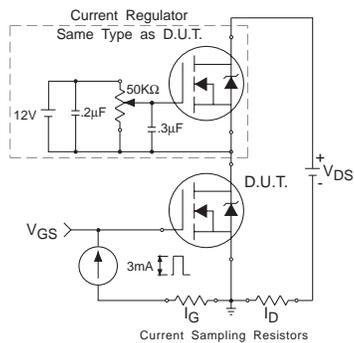
**Fig 12a.** Unclamped Inductive Test Circuit



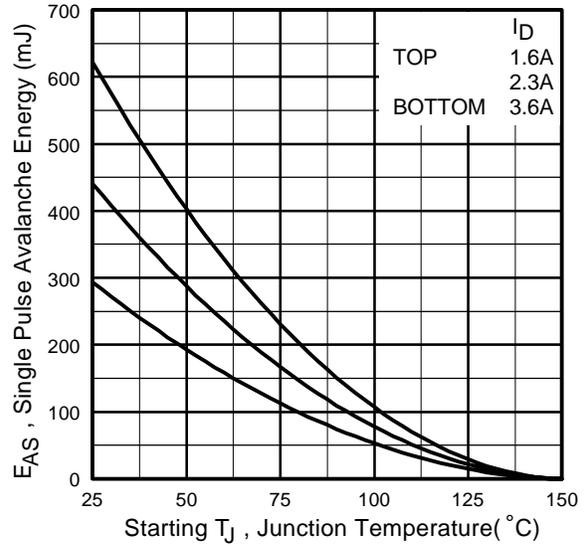
**Fig 12b.** Unclamped Inductive Waveforms



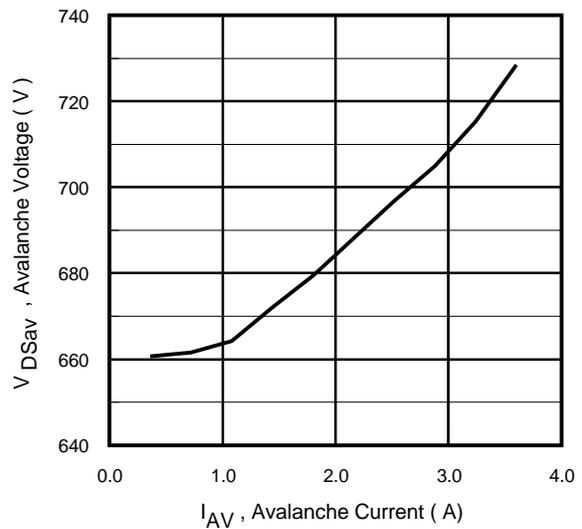
**Fig 13a.** Basic Gate Charge Waveform



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

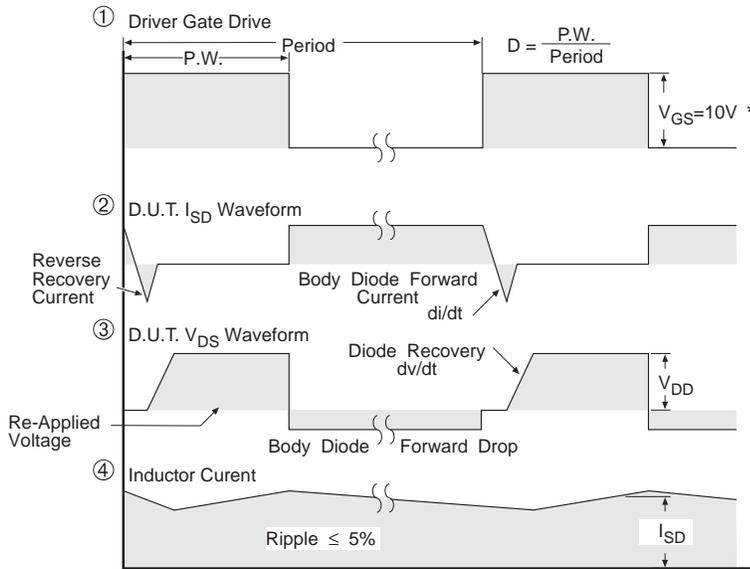
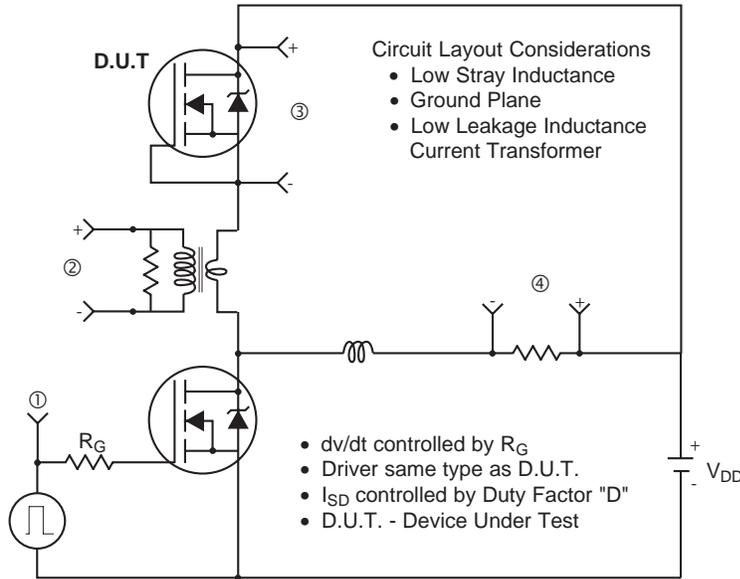


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



**Fig 12d.** Typical Drain-to-Source Voltage Vs. Avalanche Current

**Peak Diode Recovery dv/dt Test Circuit**



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

**Fig 14.** For N-Channel HEXFETS

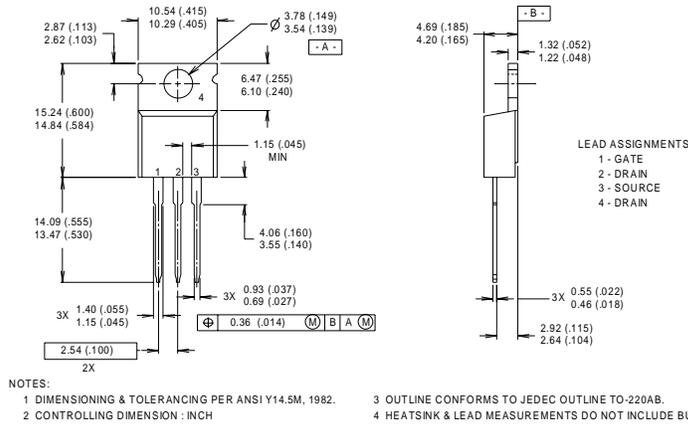
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## Package Outline

### TO-220AB Outline

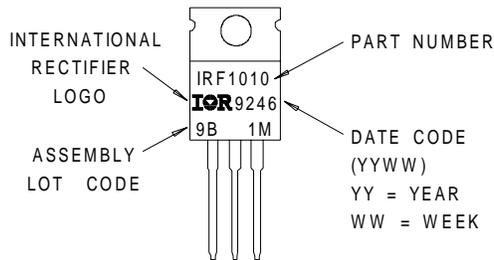
Dimensions are shown in millimeters (inches)



## Part Marking Information

### TO-220AB

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



### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 41\text{mH}$   
 $R_G = 25\Omega$ ,  $I_{AS} = 3.6\text{A}$ . (See Figure 12)
- ③  $I_{SD} \leq 3.6\text{A}$ ,  $di/dt \leq 170\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  
 $T_J \leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ⑤  $C_{OSS}$  eff. is a fixed capacitance that gives the same charging time as  $C_{OSS}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$

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Data and specifications subject to change without notice. 3/00