

**SMPS MOSFET**

**IRFP450N**

HEXFET® Power MOSFET

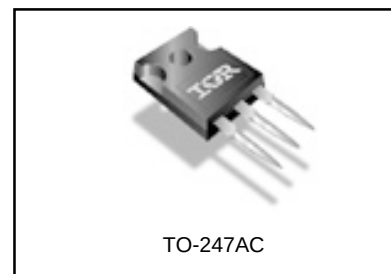
**Applications**

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching

| $V_{DSS}$ | $R_{ds(on)}$ max | $I_D$ |
|-----------|------------------|-------|
| 500V      | 0.37 $\Omega$    | 14A   |

**Benefits**

- Low Gate Charge  $Q_g$  results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic  $dv/dt$  Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Effective  $C_{oss}$  Specified (See AN 1001)



**Absolute Maximum Ratings**

|                                   | Parameter                                           | Max.                   | Units               |
|-----------------------------------|-----------------------------------------------------|------------------------|---------------------|
| $I_D$ @ $T_C = 25^\circ\text{C}$  | Continuous Drain Current, $V_{GS}$ @ 10V            | 14                     | A                   |
| $I_D$ @ $T_C = 100^\circ\text{C}$ | Continuous Drain Current, $V_{GS}$ @ 10V            | 8.8                    |                     |
| $I_{DM}$                          | Pulsed Drain Current ①                              | 56                     |                     |
| $P_D$ @ $T_C = 25^\circ\text{C}$  | Power Dissipation                                   | 200                    | W                   |
|                                   | Linear Derating Factor                              | 1.6                    | W/ $^\circ\text{C}$ |
| $V_{GS}$                          | Gate-to-Source Voltage                              | $\pm 30$               | V                   |
| $dv/dt$                           | Peak Diode Recovery $dv/dt$ ②                       | 5.0                    | V/ns                |
| $T_J$<br>$T_{STG}$                | Operating Junction and<br>Storage Temperature Range | -55 to + 150           | $^\circ\text{C}$    |
|                                   | 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 Topologies**

- Two transistor Forward
- Half Bridge and Full Bridge
- PFC Boost

Notes ① through ⑤ are on page 8

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# IRFP450N

International  
**IR** Rectifier

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

|                                 | Parameter                            | Min. | Typ. | Max. | Units               | Conditions                                            |
|---------------------------------|--------------------------------------|------|------|------|---------------------|-------------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 500  | —    | —    | V                   | $V_{GS} = 0V, I_D = 250\mu A$                         |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.59 | —    | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}, I_D = 1mA$            |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | —    | 0.37 | $\Omega$            | $V_{GS} = 10V, I_D = 8.4A$ ④                          |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 3.0  | —    | 5.0  | V                   | $V_{DS} = V_{GS}, I_D = 250\mu A$                     |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —    | 25   | $\mu A$             | $V_{DS} = 500V, V_{GS} = 0V$                          |
|                                 |                                      | —    | —    | 250  |                     | $V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | 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        | 7.9  | —    | —    | S     | $V_{DS} = 50V, I_D = 8.4A$                    |
| $Q_g$                  | Total Gate Charge               | —    | —    | 77   | nC    | $I_D = 14A$                                   |
| $Q_{gs}$               | Gate-to-Source Charge           | —    | —    | 26   |       | $V_{DS} = 400V$                               |
| $Q_{gd}$               | Gate-to-Drain ("Miller") Charge | —    | —    | 34   |       | $V_{GS} = 10V$ , See Fig. 6 and 13 ④          |
| $t_{d(on)}$            | Turn-On Delay Time              | —    | 20   | —    | ns    | $V_{DD} = 250V$                               |
| $t_r$                  | Rise Time                       | —    | 63   | —    |       | $I_D = 14A$                                   |
| $t_{d(off)}$           | Turn-Off Delay Time             | —    | 29   | —    |       | $R_G = 6.2\Omega$                             |
| $t_f$                  | Fall Time                       | —    | 25   | —    |       | $V_{GS} = 10V$ , See Fig. 10 ④                |
| $C_{iss}$              | Input Capacitance               | —    | 2260 | —    | pF    | $V_{GS} = 0V$                                 |
| $C_{oss}$              | Output Capacitance              | —    | 210  | —    |       | $V_{DS} = 25V$                                |
| $C_{rss}$              | Reverse Transfer Capacitance    | —    | 14   | —    |       | $f = 1.0MHz$ , See Fig. 5                     |
| $C_{oss}$              | Output Capacitance              | —    | 2410 | —    |       | $V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$      |
| $C_{oss}$              | Output Capacitance              | —    | 59   | —    |       | $V_{GS} = 0V, V_{DS} = 400V, f = 1.0MHz$      |
| $C_{oss \text{ eff.}}$ | Effective Output Capacitance    | —    | 110  | —    |       | $V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$ ⑤ |

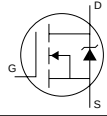
## Avalanche Characteristics

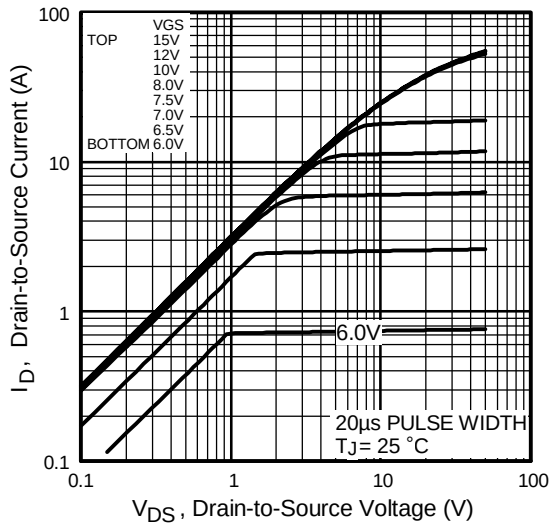
|          | Parameter                      | Typ. | Max. | Units |
|----------|--------------------------------|------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy② | —    | 170  | mJ    |
| $I_{AR}$ | Avalanche Current①             | —    | 14   | A     |
| $E_{AR}$ | Repetitive Avalanche Energy①   | —    | 20   | mJ    |

## Thermal Resistance

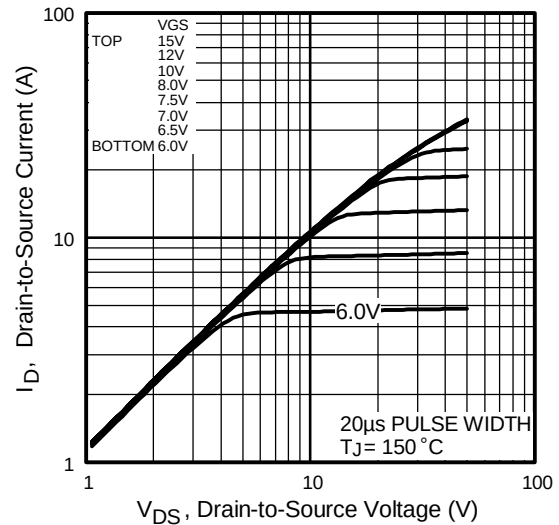
|                 | Parameter                           | Typ. | Max. | Units              |
|-----------------|-------------------------------------|------|------|--------------------|
| $R_{\theta JC}$ | Junction-to-Case                    | —    | 0.64 | $^\circ\text{C/W}$ |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.24 | —    |                    |
| $R_{\theta JA}$ | Junction-to-Ambient                 | —    | 40   |                    |

## Diode Characteristics

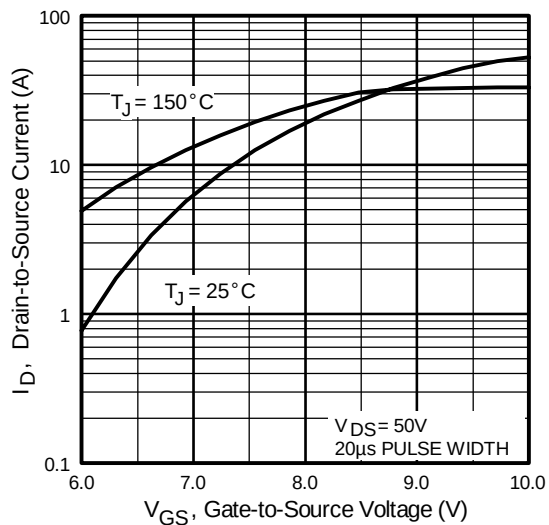
|          | Parameter                              | Min.                                                                        | Typ. | Max. | Units   | Conditions                                                                                                                                           |
|----------|----------------------------------------|-----------------------------------------------------------------------------|------|------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current (Body Diode) | —                                                                           | —    | 14   | A       | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   | —                                                                           | —    | 56   |         |                                                                                                                                                      |
| $V_{SD}$ | Diode Forward Voltage                  | —                                                                           | —    | 1.4  | V       | $T_J = 25^\circ\text{C}, I_S = 14A, V_{GS} = 0V$ ④                                                                                                   |
| $t_{rr}$ | Reverse Recovery Time                  | —                                                                           | 430  | 650  | ns      | $T_J = 25^\circ\text{C}, I_F = 14A$                                                                                                                  |
| $Q_{rr}$ | Reverse Recovery Charge                | —                                                                           | 3.7  | 5.6  | $\mu C$ | $di/dt = 100A/\mu s$ ④                                                                                                                               |
| $t_{on}$ | Forward Turn-On Time                   | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ ) |      |      |         |                                                                                                                                                      |



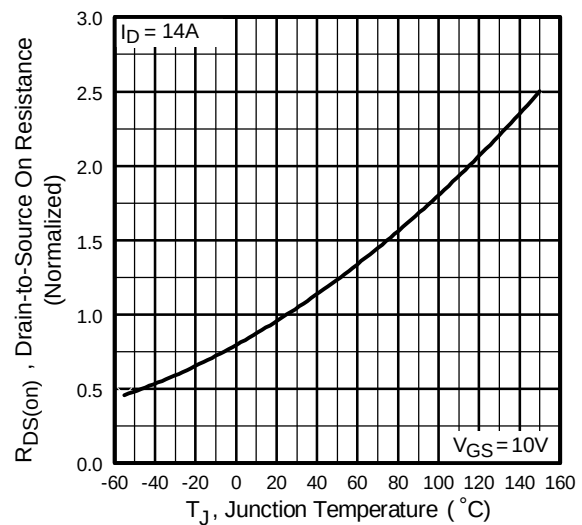
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



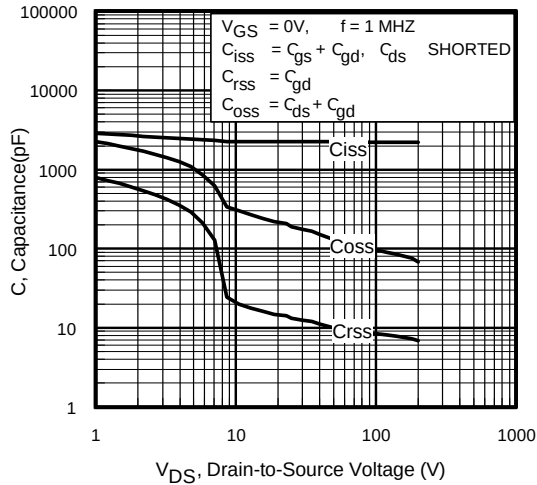
**Fig 3.** Typical Transfer Characteristics



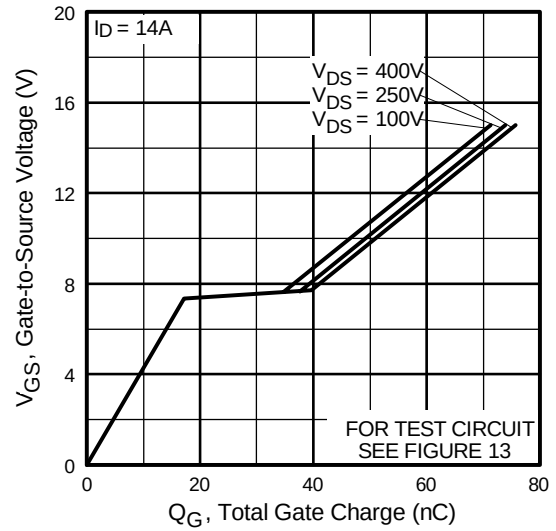
**Fig 4.** Normalized On-Resistance Vs. Temperature

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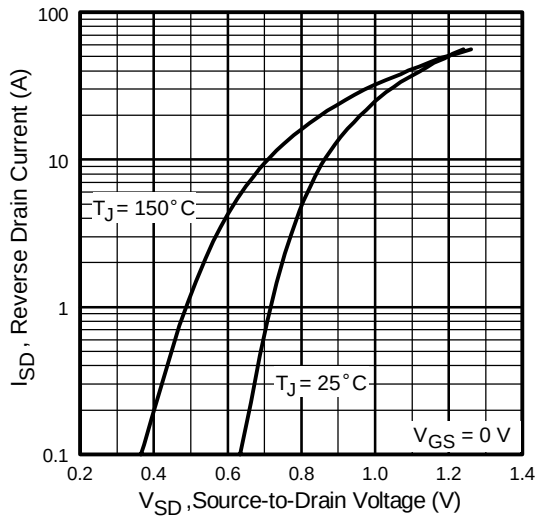
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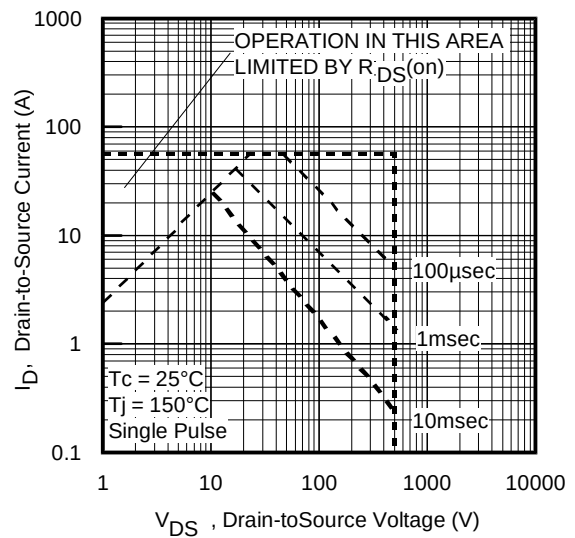
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



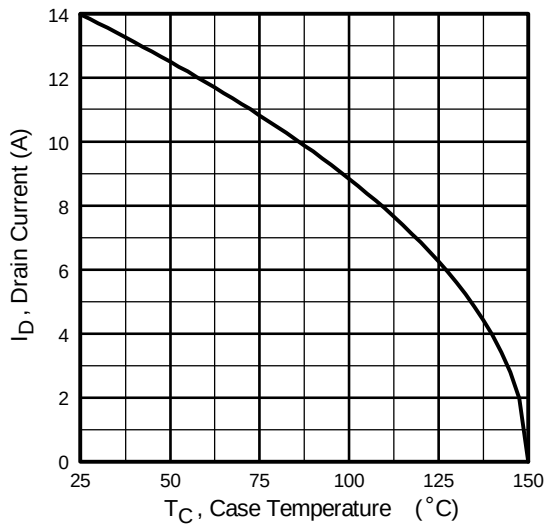
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



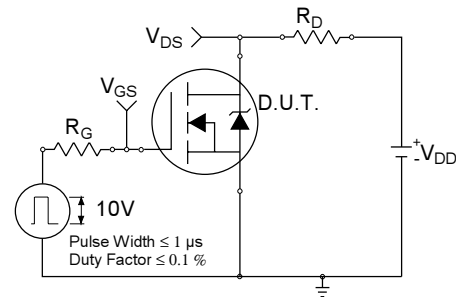
**Fig 7.** Typical Source-Drain Diode Forward Voltage



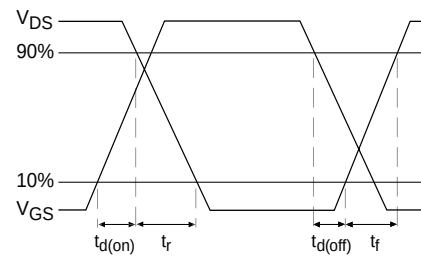
**Fig 8.** Maximum Safe Operating Area



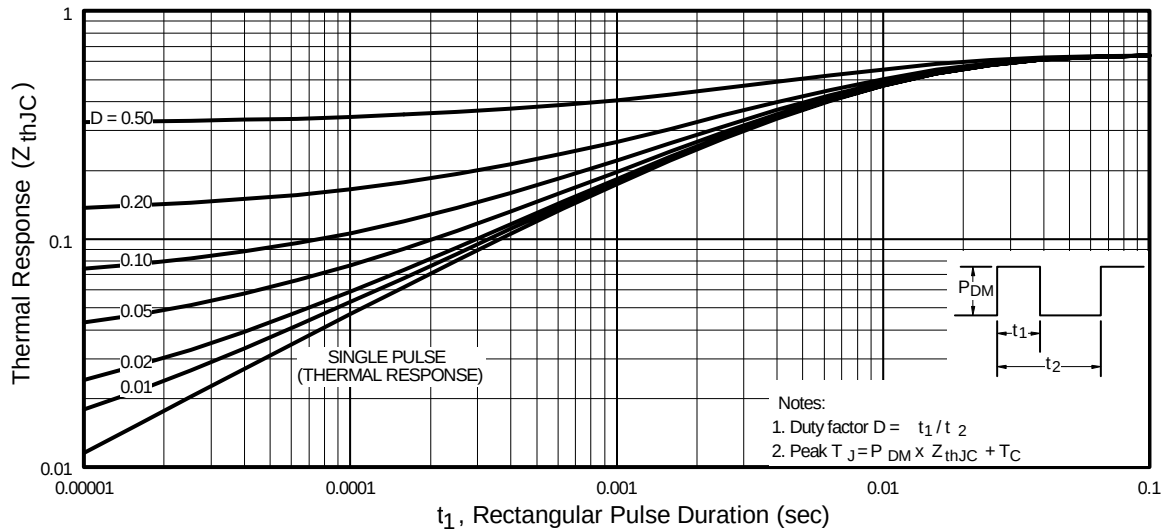
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



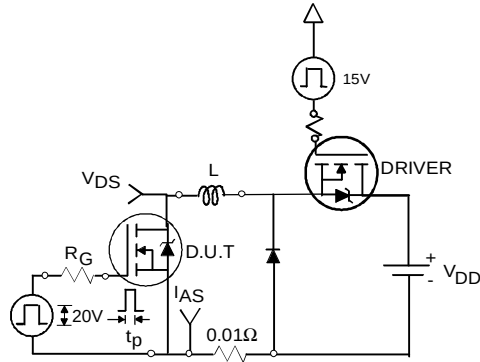
**Fig 10b.** Switching Time Waveforms



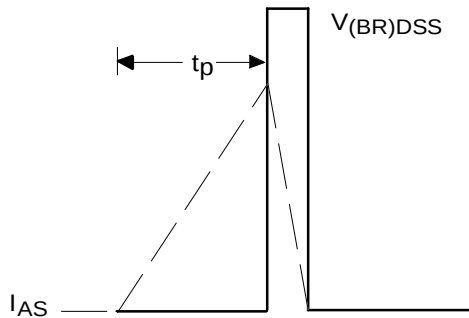
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

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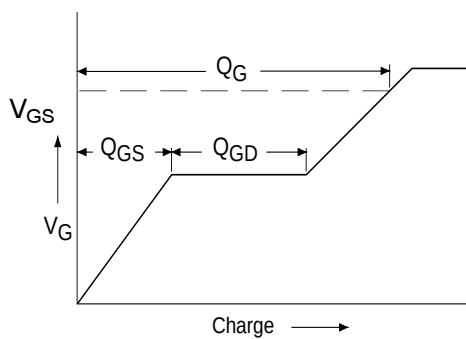
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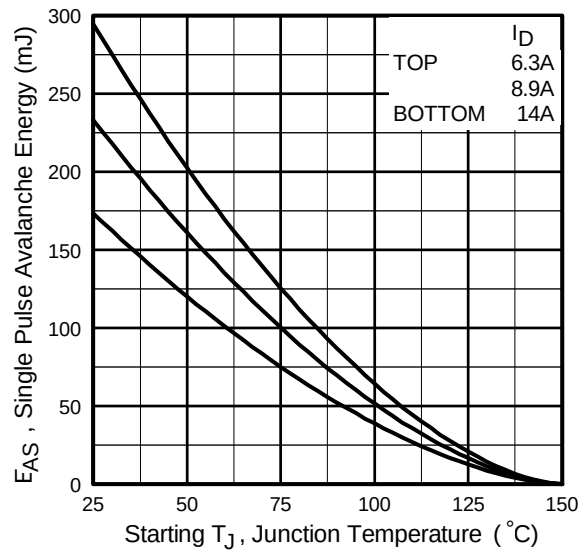
**Fig 12a.** Unclamped Inductive Test Circuit



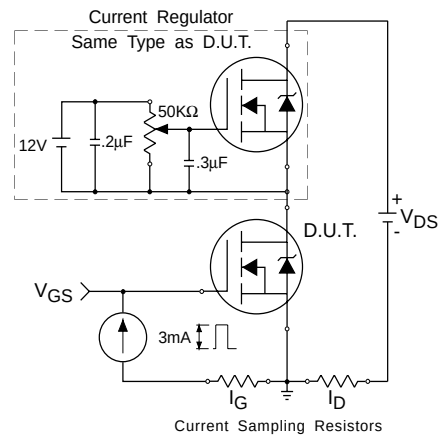
**Fig 12b.** Unclamped Inductive Waveforms



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

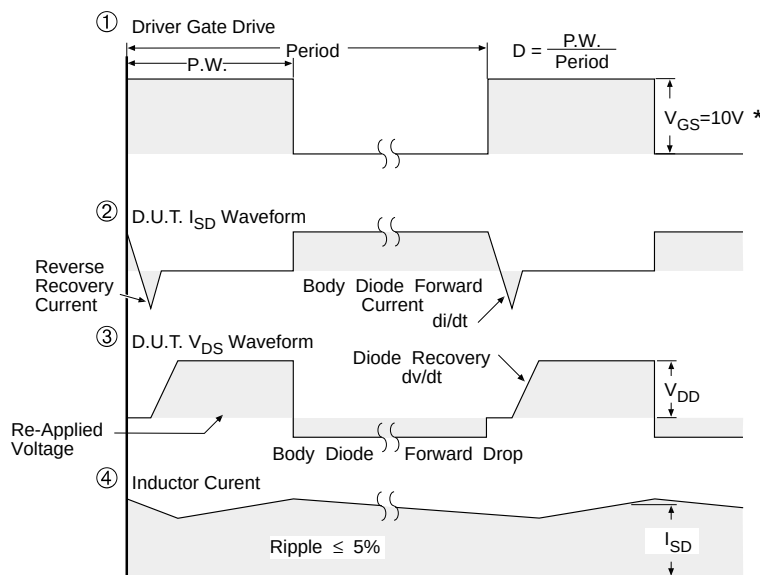
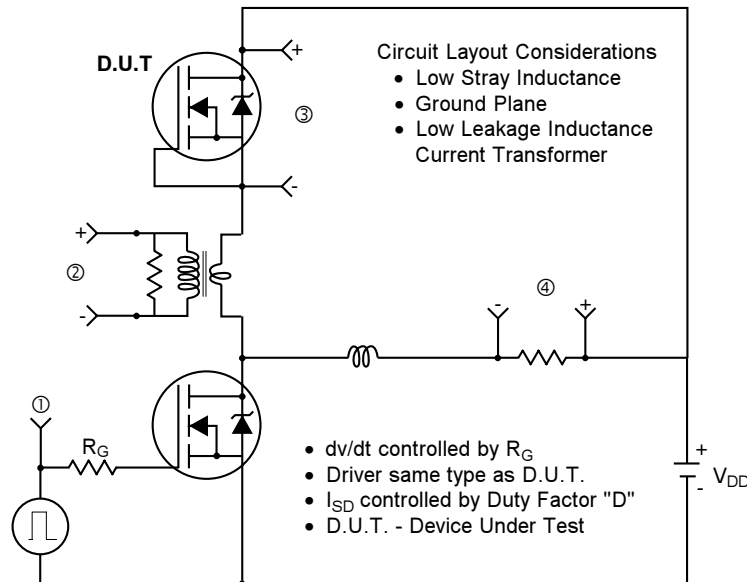


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



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

## Peak Diode Recovery dv/dt Test Circuit

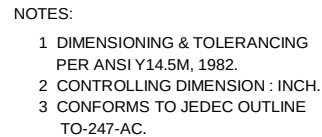


\*  $V_{GS} = 5V$  for Logic Level Devices

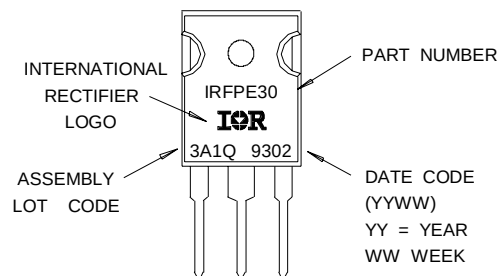
**Fig 14.** For N-Channel HEXFETS

International  
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Dimensions are shown in millimeters (inches)



EXAMPLE : THIS IS AN IRFPE30  
WITH ASSEMBLY  
LOT CODE 3A1Q



**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 1.7\text{mH}$   
 $R_G = 25\Omega$ ,  $I_{AS} = 14\text{A}$ . (See Figure 12)
- ③  $I_{SD} \leq 14\text{A}$ ,  $di/dt \leq 510\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  
 $T_J \leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 400\mu\text{s}$ ; 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  $80\% V_{DSS}$
- Data and specifications subject to change without notice

Data and specifications subject to change without notice.

This product has been designed and qualified for the Automotive [Q101] market. Qualification Standards can be found on IR's Web site.

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