

# IRFP048N

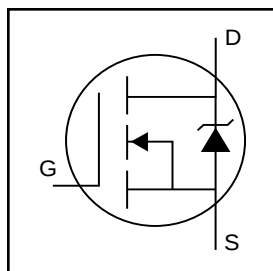
HEXFET® Power MOSFET

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

## Description

Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

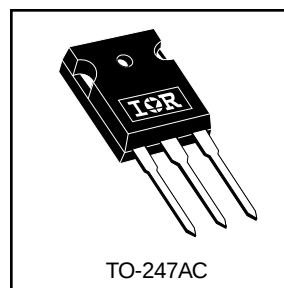
The TO-247 package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220 devices. The TO-247 is similar but superior to the earlier TO-218 package because of its isolated mounting hole.



$$V_{DSS} = 55V$$

$$R_{DS(on)} = 0.016\Omega$$

$$I_D = 64A$$



## Absolute Maximum Ratings

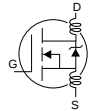
|                             | Parameter                                | Max.                   | Units |
|-----------------------------|------------------------------------------|------------------------|-------|
| $I_D$ @ $T_C = 25^\circ C$  | Continuous Drain Current, $V_{GS}$ @ 10V | 64                     | A     |
| $I_D$ @ $T_C = 100^\circ C$ | Continuous Drain Current, $V_{GS}$ @ 10V | 45                     |       |
| $I_{DM}$                    | Pulsed Drain Current ①⑤                  | 210                    |       |
| $P_D$ @ $T_C = 25^\circ C$  | Power Dissipation                        | 140                    | W     |
|                             | Linear Derating Factor                   | 0.90                   | W/°C  |
| $V_{GS}$                    | Gate-to-Source Voltage                   | $\pm 20$               | V     |
| $E_{AS}$                    | Single Pulse Avalanche Energy②⑤          | 270                    | mJ    |
| $I_{AR}$                    | Avalanche Current①⑤                      | 32                     | A     |
| $E_{AR}$                    | Repetitive Avalanche Energy①             | 14                     | mJ    |
| dv/dt                       | Peak Diode Recovery dv/dt ③⑤             | 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                           | Typ. | Max. | Units |
|-----------------|-------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case                    | —    | 1.1  | °C/W  |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.24 | —    |       |
| $R_{\theta JA}$ | Junction-to-Ambient                 | —    | 40   |       |

## 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 $25^\circ\text{C}$ , $I_D = 1mA$ ⑤            |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | —     | 0.016 | $\Omega$            | $V_{GS} = 10V$ , $I_D = 37A$ 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             | 22   | —     | —     | S                   | $V_{DS} = 25V$ , $I_D = 32A$ ⑤                             |
| $I_{DSS}$                       | 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                    | —    | —     | 89    | nC                  | $I_D = 32A$                                                |
| $Q_{gs}$                        | Gate-to-Source Charge                | —    | —     | 20    |                     | $V_{DS} = 44V$                                             |
| $Q_{gd}$                        | Gate-to-Drain ("Miller") Charge      | —    | —     | 39    |                     | $V_{GS} = 10V$ , See Fig. 6 and 13 ④⑤                      |
| $t_{d(on)}$                     | Turn-On Delay Time                   | —    | 11    | —     | ns                  | $V_{DD} = 28V$                                             |
| $t_r$                           | Rise Time                            | —    | 78    | —     |                     | $I_D = 32A$                                                |
| $t_{d(off)}$                    | Turn-Off Delay Time                  | —    | 32    | —     |                     | $R_G = 5.1\Omega$                                          |
| $t_f$                           | Fall Time                            | —    | 48    | —     |                     | $R_D = 0.85\Omega$ , See Fig. 10 ④⑤                        |
| $L_D$                           | Internal Drain Inductance            | —    | 5.0   | —     | nH                  | Between lead,<br>6mm (0.25in.)                             |
| $L_S$                           | Internal Source Inductance           | —    | 13    | —     |                     | from package<br>and center of die contact                  |
| $C_{iss}$                       | Input Capacitance                    | —    | 1900  | —     | pF                  | $V_{GS} = 0V$                                              |
| $C_{oss}$                       | Output Capacitance                   | —    | 620   | —     |                     | $V_{DS} = 25V$                                             |
| $C_{rss}$                       | Reverse Transfer Capacitance         | —    | 270   | —     |                     | $f = 1.0MHz$ , See Fig. 5⑤                                 |



## Source-Drain Ratings and Characteristics

|          | Parameter                              | Min. | Typ. | Max. | Units | Conditions                                                     |
|----------|----------------------------------------|------|------|------|-------|----------------------------------------------------------------|
| $I_S$    | Continuous Source Current (Body Diode) | —    | —    | 45   | A     | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①⑤  | —    | —    | 210  |       |                                                                |
| $V_{SD}$ | Diode Forward Voltage                  | —    | —    | 1.3  | V     | $T_J = 25^\circ\text{C}$ , $I_S = 37A$ , $V_{GS} = 0V$ ④       |
| $t_{rr}$ | Reverse Recovery Time                  | —    | 94   | 140  | ns    | $T_J = 25^\circ\text{C}$ , $I_F = 32A$                         |
| $Q_{rr}$ | Reverse Recovery Charge                | —    | 360  | 540  | nC    | $di/dt = 100A/\mu s$ ④⑤                                        |

### Notes:

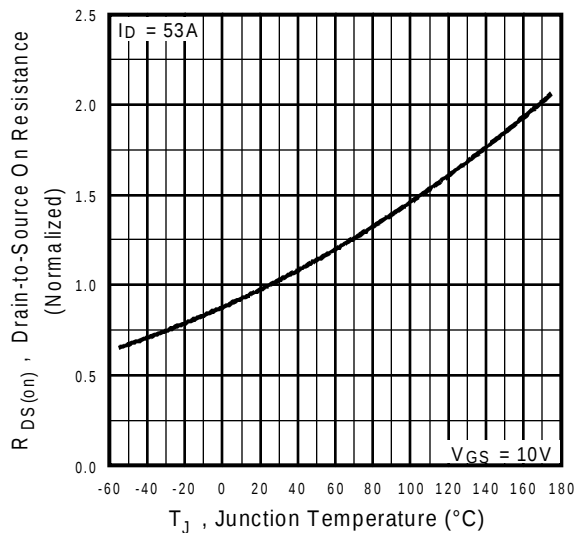
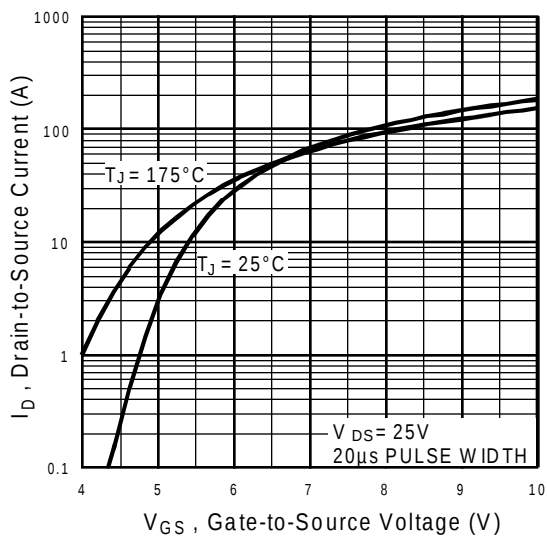
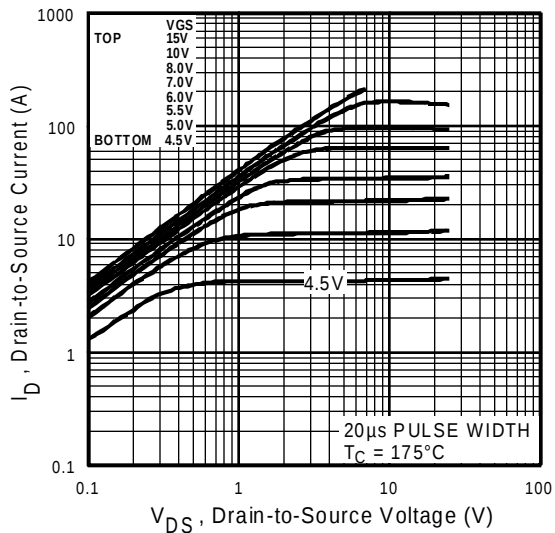
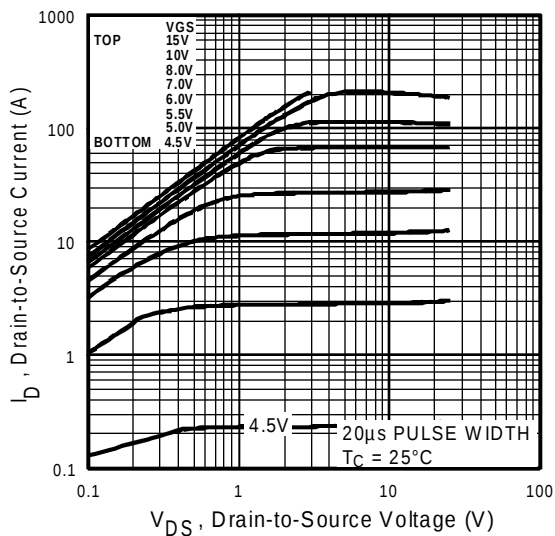
① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )

②  $V_{DD} = 25V$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 530\mu H$   
 $R_G = 25\Omega$ ,  $I_{AS} = 32A$ . (See Figure 12)

③  $I_{SD} \leq 32A$ ,  $di/dt \leq 250A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  
 $T_J \leq 175^\circ\text{C}$

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

⑤ Uses IRFZ48N data and test conditions



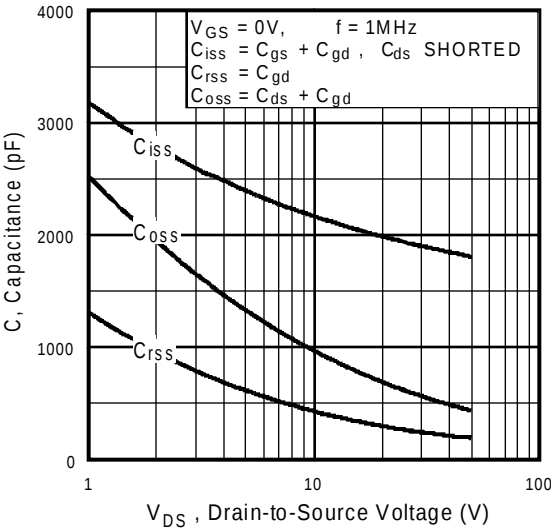


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

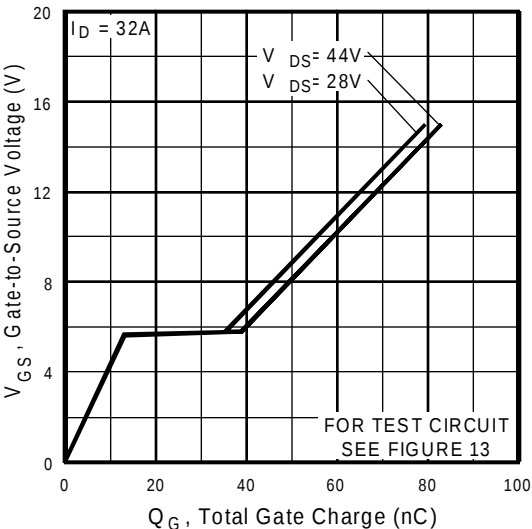


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

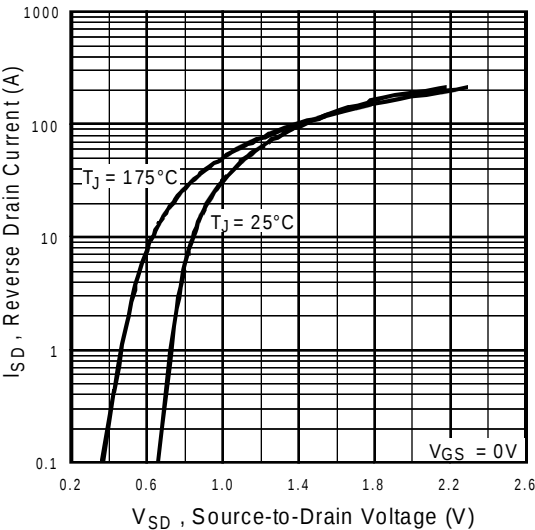


Fig 7. Typical Source-Drain Diode Forward Voltage

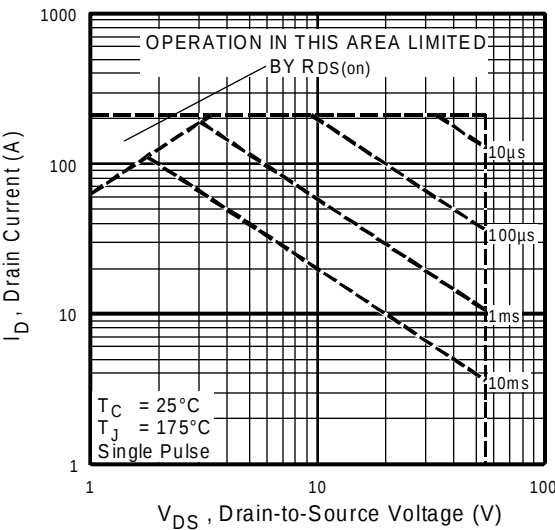
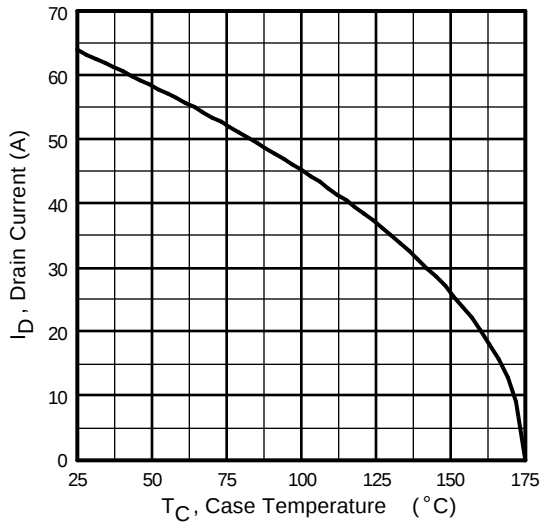
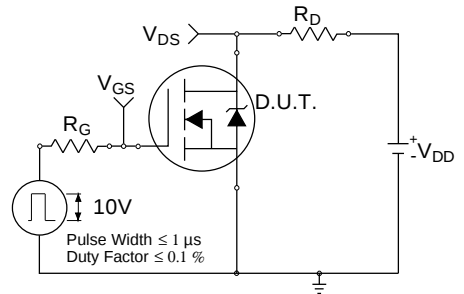


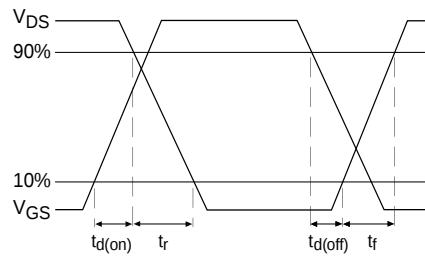
Fig 8. Maximum Safe Operating Area



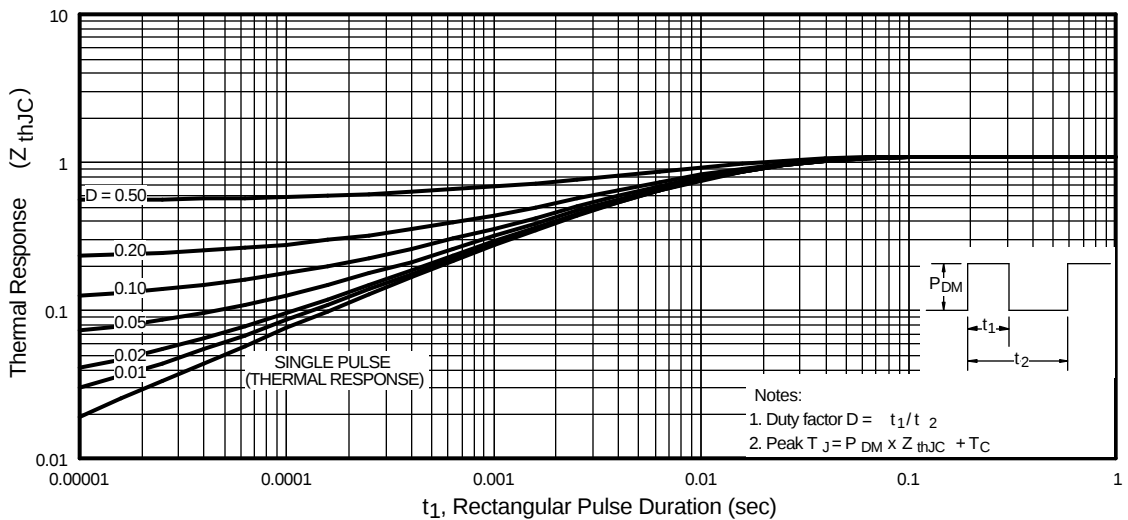
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



**Fig 10b.** Switching Time Waveforms



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

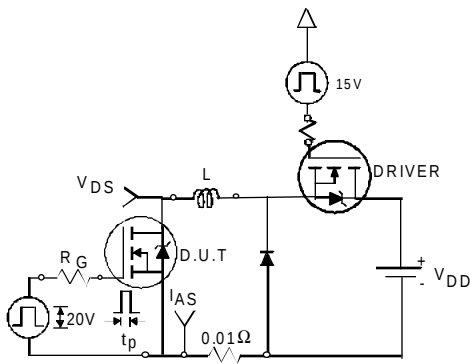


Fig 12a. Unclamped Inductive Test Circuit

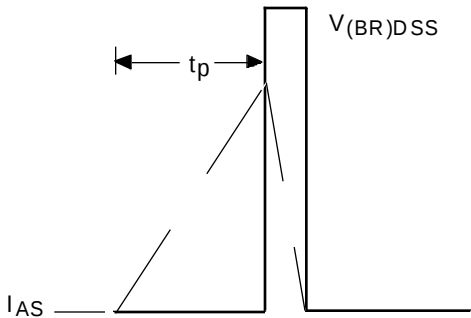


Fig 12b. Unclamped Inductive Waveforms

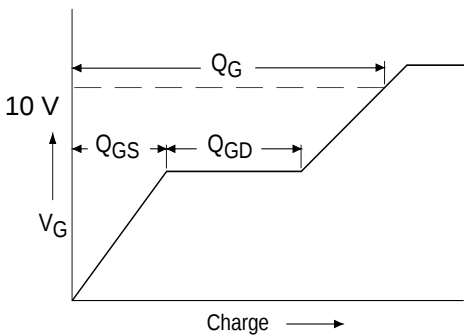


Fig 13a. Basic Gate Charge Waveform

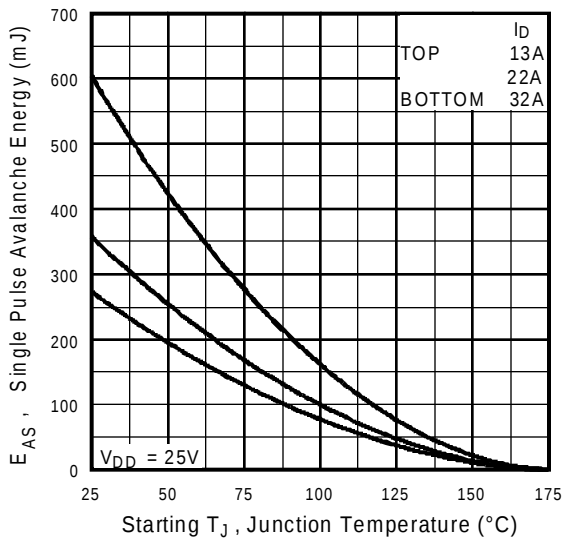


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

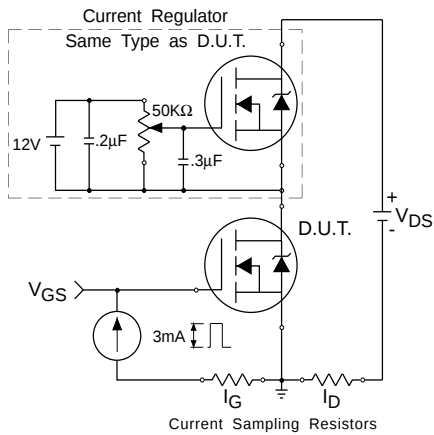
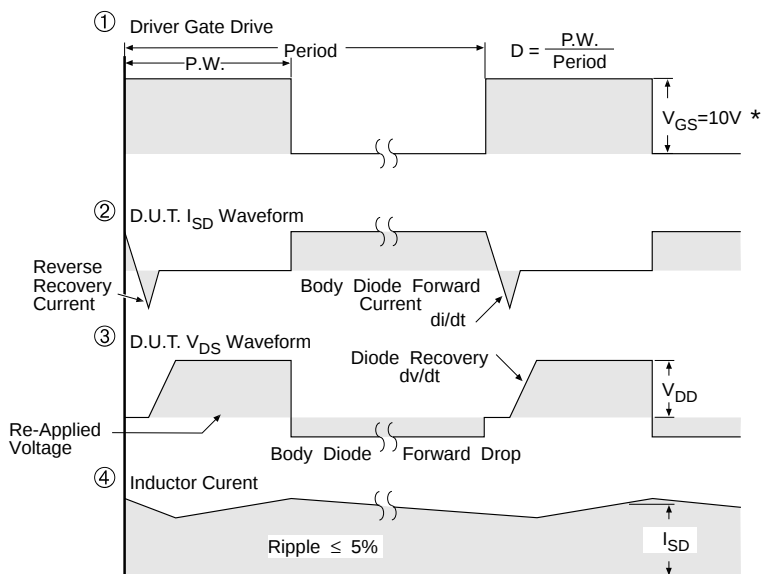
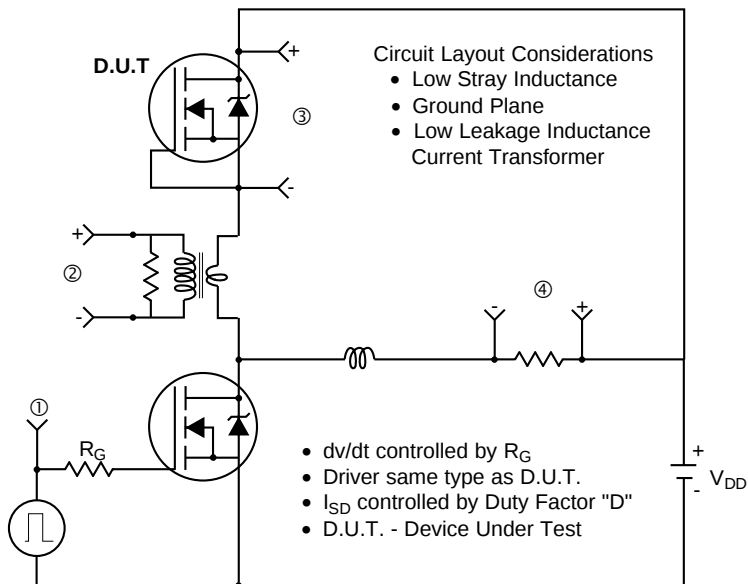


Fig 13b. Gate Charge Test Circuit

## Peak Diode Recovery dv/dt Test Circuit

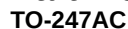


\*  $V_{GS} = 5V$  for Logic Level Devices

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

International  
**IOR** Rectifier

Dimensions are shown in millimeters (inches)



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