

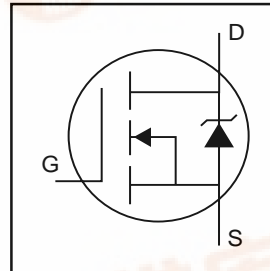
# International IOR Rectifier

PD - 93912A

## IRFPS3810

HEXFET® Power MOSFET

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



|                            |
|----------------------------|
| $V_{DSS} = 100V$           |
| $R_{DS(on)} = 0.009\Omega$ |
| $I_D = 170A\text{⑥}$       |

### Description

The HEXFET® Power MOSFETs 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.



### Absolute Maximum Ratings

|                           | Parameter                                | Max.                   | Units |
|---------------------------|--|------------------------|-------|
| $I_D @ T_C = 25^\circ C$  | Continuous Drain Current, $V_{GS} @ 10V$ | 170⑥                   | A     |
| $I_D @ T_C = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 120⑥                   |       |
| $I_{DM}$                  | Pulsed Drain Current ①                   | 670                    |       |
| $P_D @ T_C = 25^\circ C$  | Power Dissipation                        | 580                    | W     |
|                           | Linear Derating Factor                   | 3.8                    | W/°C  |
| $V_{GS}$                  | Gate-to-Source Voltage                   | $\pm 30$               | V     |
| $E_{AS}$                  | Single Pulse Avalanche Energy②           | 1350                   | mJ    |
| $I_{AR}$                  | Avalanche Current①                       | 100                    | A     |
| $E_{AR}$                  | Repetitive Avalanche Energy①             | 58                     | mJ    |
| dv/dt                     | Peak Diode Recovery dv/dt ③              | 2.3                    | 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 ) |       |

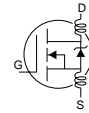
### Thermal Resistance

|                 | Parameter                           | Typ. | Max. | Units |
|-----------------|-------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case                    | —    | 0.26 | °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    | 100  | —     | —     | V                   | $V_{GS} = 0V, I_D = 250\mu A$   |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.11  | —     | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$                           |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | —     | 0.009 | $\Omega$            | $V_{GS} = 10V, I_D = 100A$ ④  |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 3.0  | —     | 5.0   | V                   | $V_{DS} = 10V, I_D = 250\mu A$  |
| $g_{fs}$                        | Forward Transconductance             | 52   | —     | —     | S                   | $V_{DS} = 50V, I_D = 100A$  |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —     | 25    | $\mu A$             | $V_{DS} = 100V, V_{GS} = 0V$  |
|                                 |                                      | —    | —     | 250   |                     | $V_{DS} = 80V, V_{GS} = 0V, T_J = 150^\circ\text{C}$                        |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —     | 100   | nA                  | $V_{GS} = 30V$  |
|                                 | Gate-to-Source Reverse Leakage       | —    | —     | -100  |                     | $V_{GS} = -30V$   |
| $Q_g$                           | Total Gate Charge                    | —    | 260   | 390   | nC                  | $I_D = 100A$  |
| $Q_{gs}$                        | Gate-to-Source Charge                | —    | 49    | 74    |                     | $V_{DS} = 80V$  |
| $Q_{gd}$                        | Gate-to-Drain ("Miller") Charge      | —    | 160   | 250   |                     | $V_{GS} = 10V$ ④  |
| $t_{d(on)}$                     | Turn-On Delay Time                   | —    | 24    | —     |                     | ns  |
| $t_r$                           | Rise Time                            | —    | 270   | —     | $I_D = 100A$        |   |
| $t_{d(off)}$                    | Turn-Off Delay Time                  | —    | 45    | —     | $R_G = 1.03\Omega$  |   |
| $t_f$                           | Fall Time                            | —    | 140   | —     | $V_{GS} = 10V$ ④    |   |
| $L_D$                           | Internal Drain Inductance            | —    | 5.0   | —     | nH                  | Between lead,<br>6mm (0.25in.)<br>from package<br>and center of die contact |
| $L_S$                           | Internal Source Inductance           | —    | 13    | —     |                     |   |
| $C_{iss}$                       | Input Capacitance                    | —    | 6790  | —     | pF                  | $V_{GS} = 0V$   |
| $C_{oss}$                       | Output Capacitance                   | —    | 2470  | —     |                     | $V_{DS} = 25V$  |
| $C_{rss}$                       | Reverse Transfer Capacitance         | —    | 990   | —     |                     | $f = 1.0\text{MHz}$ , See Fig. 5  |
| $C_{oss}$                       | Output Capacitance                   | —    | 10740 | —     |                     | $V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$                             |
| $C_{oss}$                       | Output Capacitance                   | —    | 1180  | —     |                     | $V_{GS} = 0V, V_{DS} = 80V, f = 1.0\text{MHz}$                              |
| $C_{oss\ eff.}$                 | Effective Output Capacitance ⑤       | —    | 2210  | —     |                     | $V_{GS} = 0V, V_{DS} = 0V\ \text{to}\ 80V$                                  |



## Source-Drain Ratings and Characteristics

|          | Parameter                                 | Min.  | Typ. | Max. | Units | Conditions  |
|----------|---|---|------|------|-------|---|
| $I_S$    | Continuous Source Current<br>(Body Diode) | —   | —    | 170  | A     | MOSFET symbol<br>showing the<br>integral reverse<br>p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current<br>(Body Diode) ①   | —   | —    | 670  |       |   |
| $V_{SD}$ | Diode Forward Voltage                     | —   | —    | 1.3  | V     | $T_J = 25^\circ\text{C}, I_S = 100A, V_{GS} = 0V$ ④                     |
| $t_{rr}$ | Reverse Recovery Time                     | —   | 220  | 330  | ns    | $T_J = 25^\circ\text{C}, I_F = 100A$                                    |
| $Q_{rr}$ | Reverse Recovery Charge                   | —   | 1640 | 2460 | 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 Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.27\text{mH}$   
 $R_G = 25\Omega, I_{AS} = 100A$ . (See Figure 12)
- ③  $I_{SD} \leq 100A, di/dt \leq 350A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 175^\circ\text{C}$

- ④ Pulse width  $\leq 400\mu s$ ; 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%  $V_{DSS}$
- ⑥ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 105A.

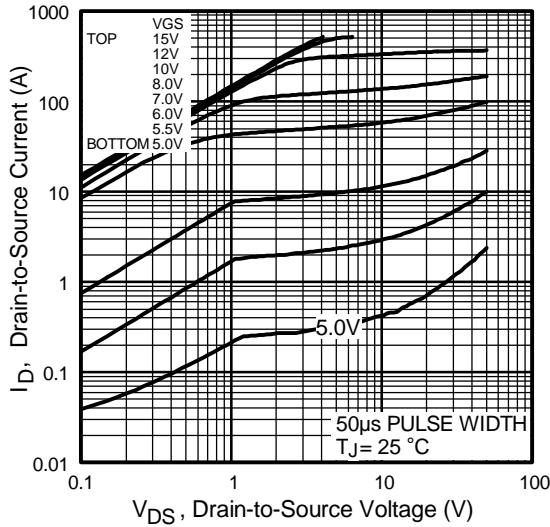


Fig 1. Typical Output Characteristics

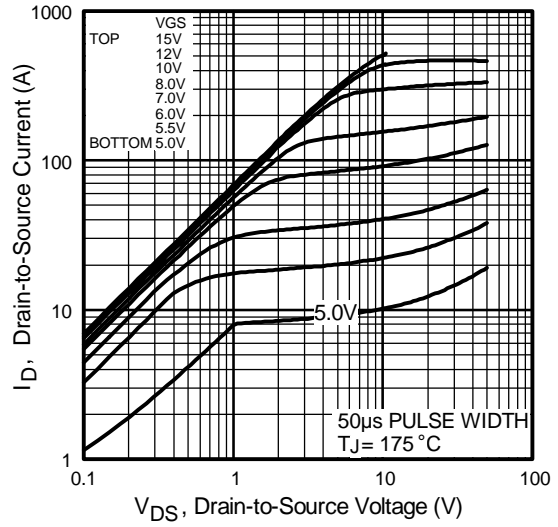


Fig 2. Typical Output Characteristics

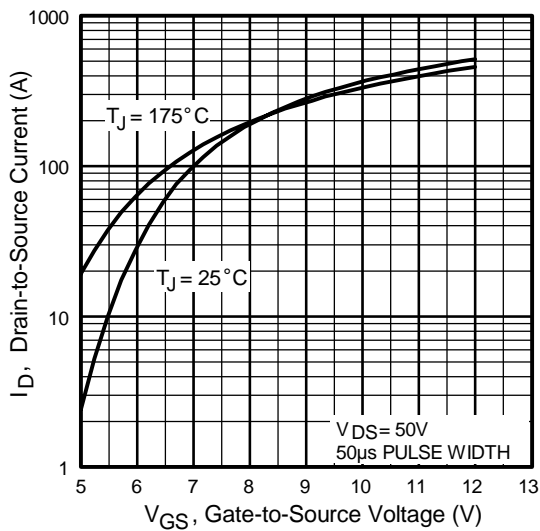


Fig 3. Typical Transfer Characteristics

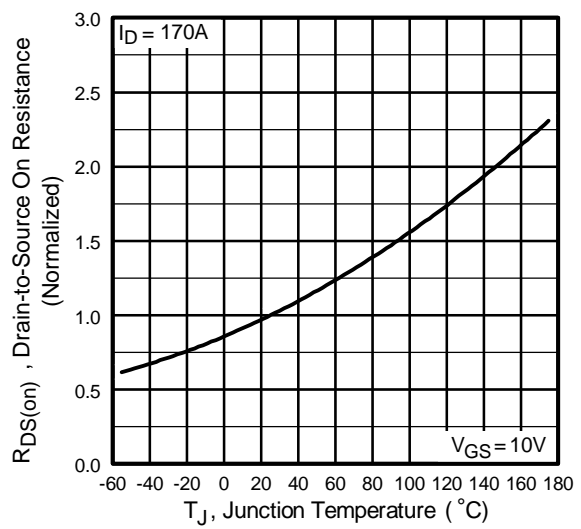
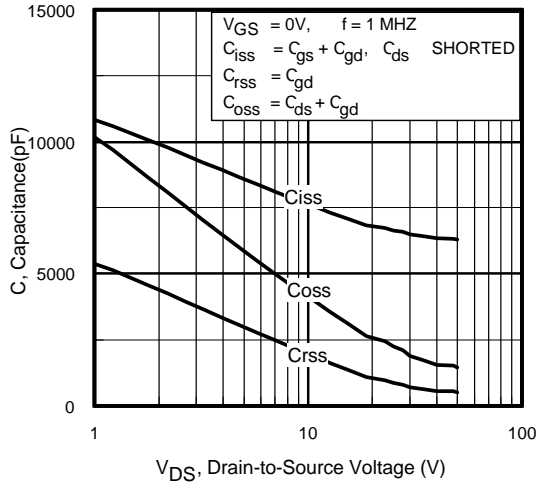
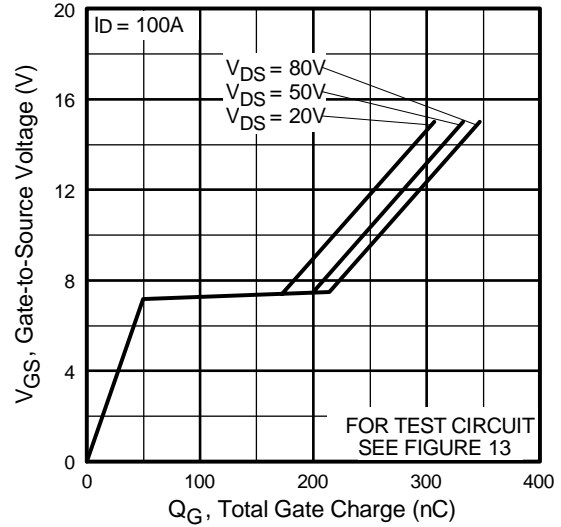


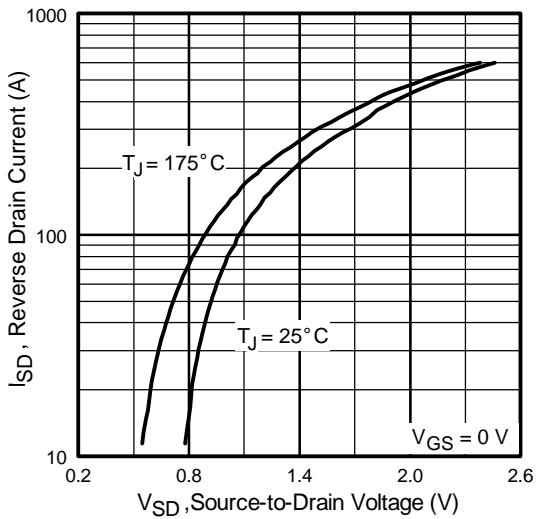
Fig 4. Normalized On-Resistance Vs. Temperature



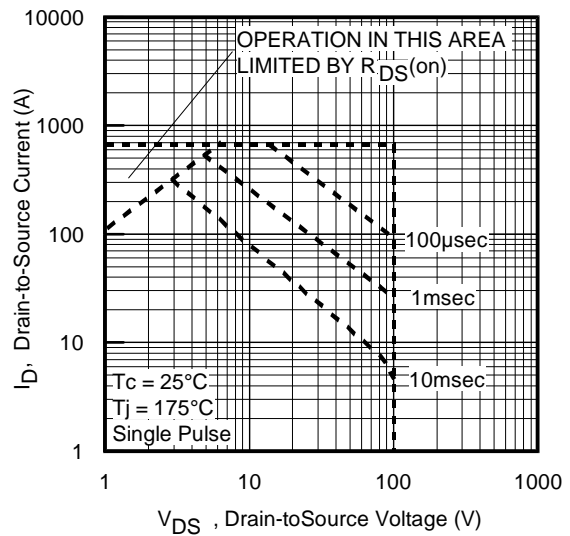
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



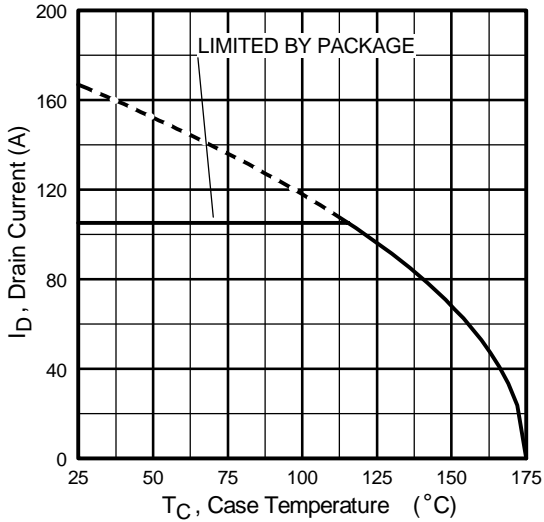
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



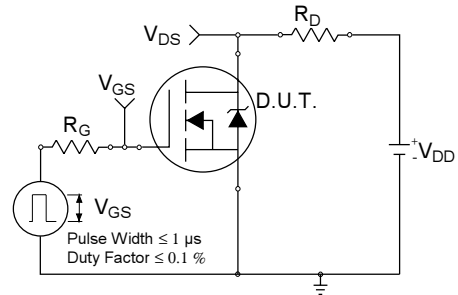
**Fig 7.** Typical Source-Drain Diode Forward Voltage



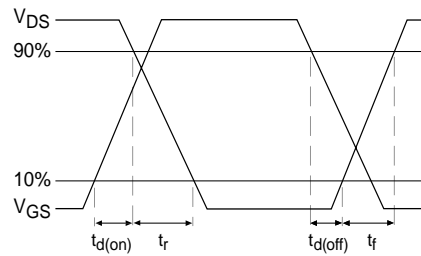
**Fig 8.** Maximum Safe Operating Area



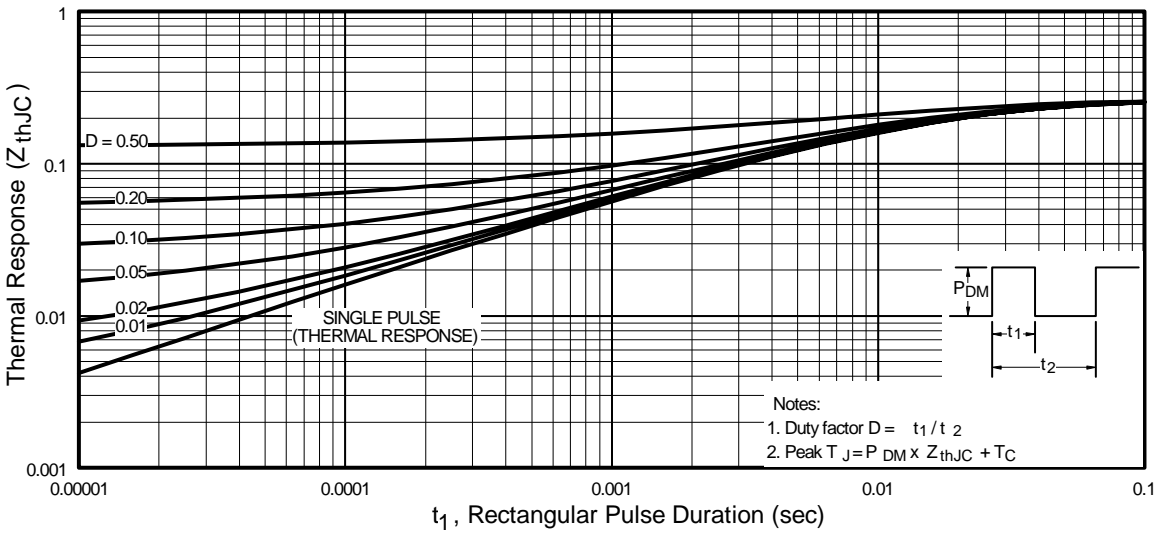
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



**Fig 10b.** Switching Time Waveforms



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

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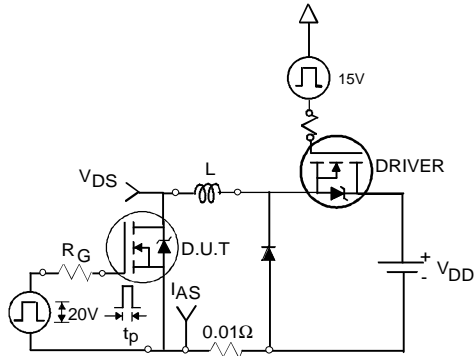


Fig 12a. Unclamped Inductive Test Circuit

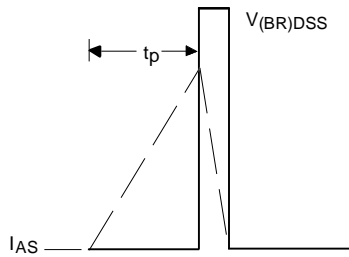


Fig 12b. Unclamped Inductive Waveforms

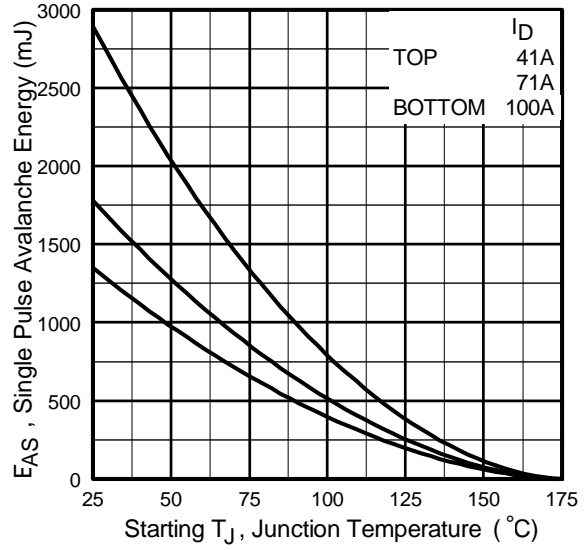


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

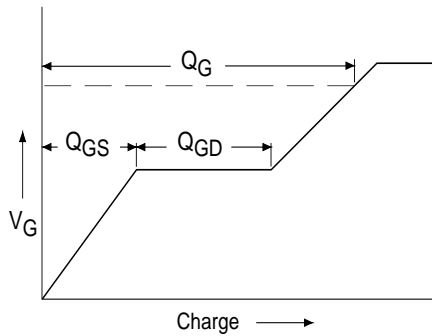


Fig 13a. Basic Gate Charge Waveform

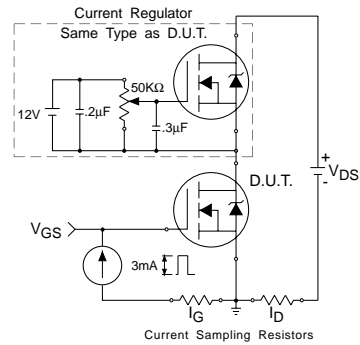
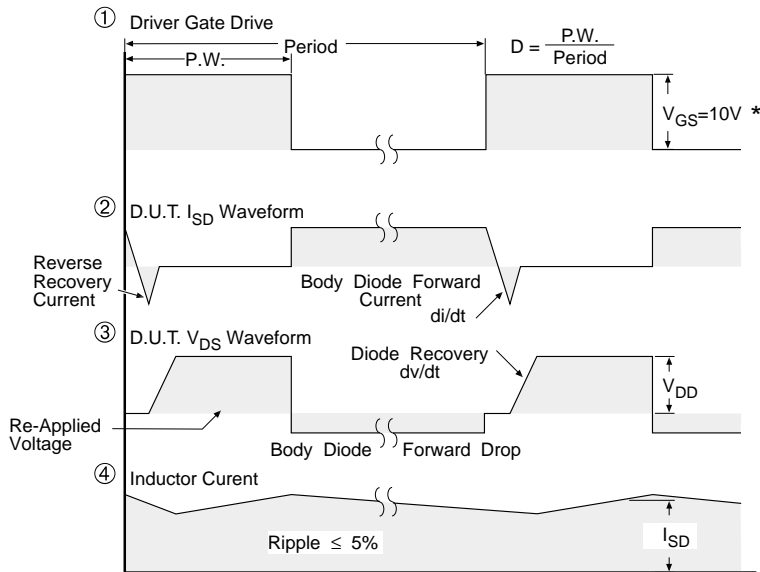
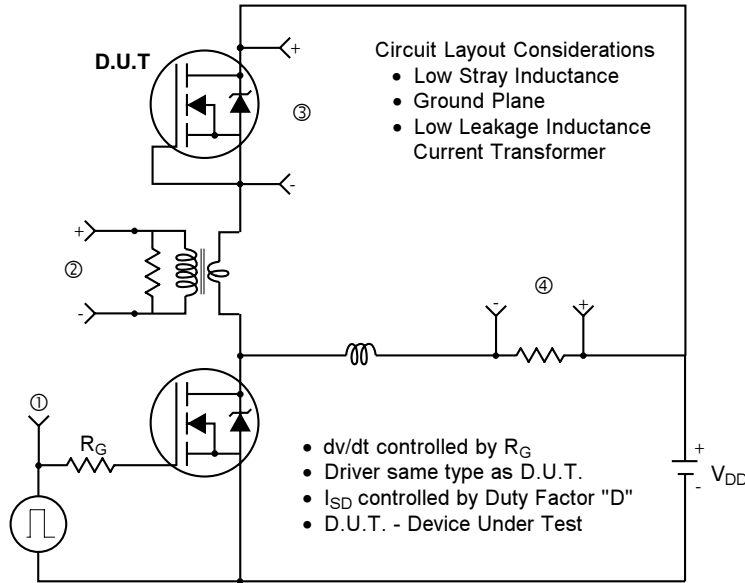


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



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

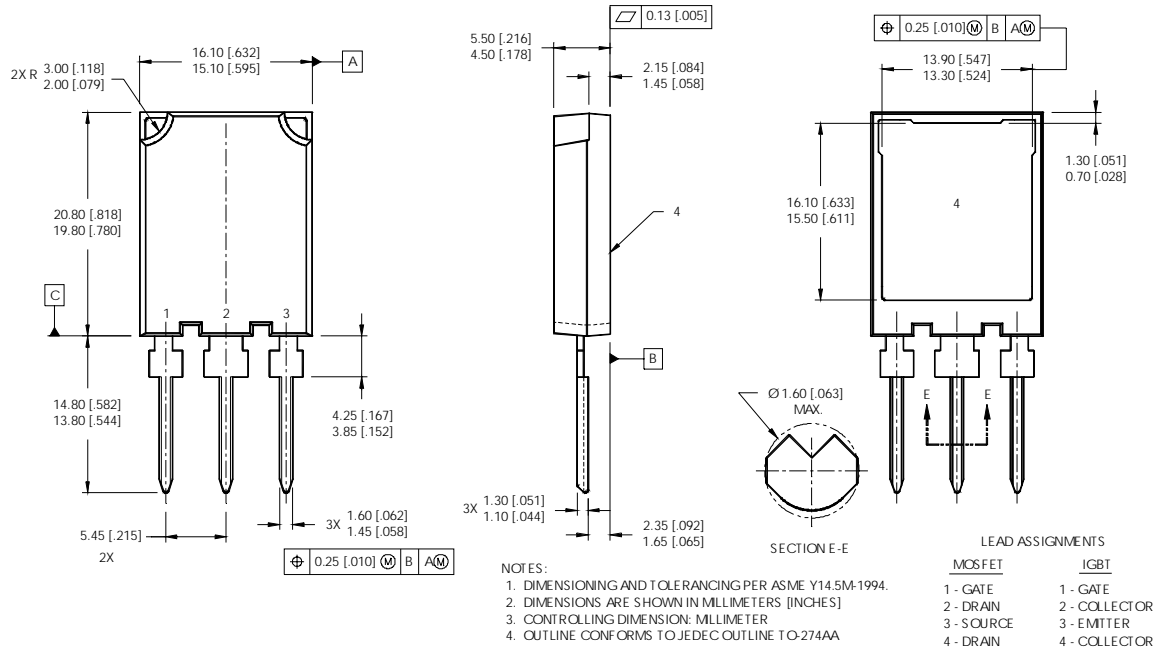
Fig 14. For N-Channel HEXFET® Power MOSFETs

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## Super-247™ Package Outline



Data and specifications subject to change without notice.  
This product has been designed and qualified for the Industrial market.  
Qualification Standards can be found on IR's Web site.

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