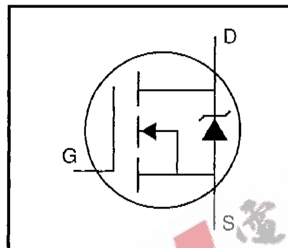
International
IOR Rectifier

PD - 9.543C

# IRFPG50

HEXFET® Power MOSFET

- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Isolated Central Mounting Hole
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements




$V_{DSS}$ = 1000V

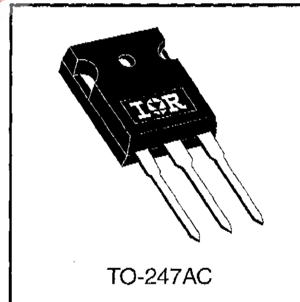
$R_{DS(on)}$ = 2.0Ω

$I_D$ = 6.1A

## Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

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. It also provides greater creepage distance between pins to meet the requirements of most safety specifications.




TO-247AC

## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10 V | 6.1 | |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10 V | 3.9 | A |
| $I_{DM}$ | Pulsed Drain Current ① | 24 | |
| $P_D$ @ $T_C$ = 25°C | Power Dissipation | 190 | W |
| | Linear Derating Factor | 1.5 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ±20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy ② | 800 | mJ |
| $I_{AR}$ | Avalanche Current ① | 6.0 | A |
| $E_{AR}$ | Repetitive Avalanche Energy ① | 19 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ③ | 1.0 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to +150 | °C |
| | Soldering Temperature, for 10 seconds | 300 (1.6mm from case) | |
| | Mounting Torque, 6-32 or M3 screw | 10 lbf•in (1.1 N•m) | |

## Thermal Resistance

| | Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | — | — | 0.65 | |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | — | 0.24 | — | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient | — | — | 40 | |

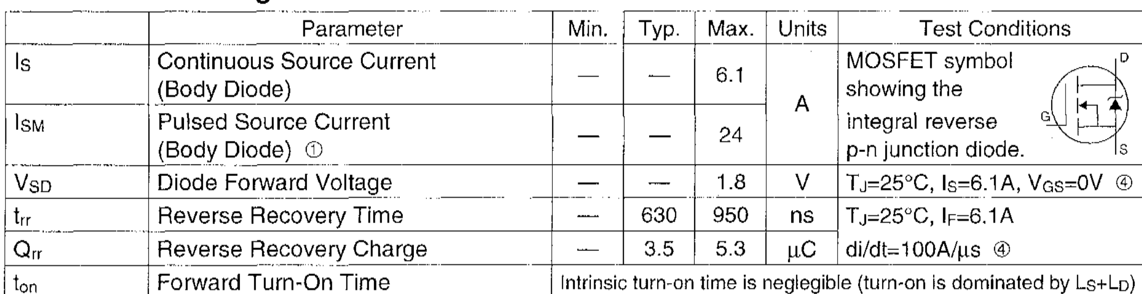


10/29/97

## Electrical Characteristics @ $T_J = 25°C$ (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 1000 | — | — | V | $V_{GS}$=0V, $I_D$= 250μA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 1.2 | — | V/°C | Reference to 25°C, $I_D$= 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 2.0 | Ω | $V_{GS}$=10V, $I_D$=3.6A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | — | 4.0 | V | $V_{DS}$=$V_{GS}$, $I_D$= 250μA |
| $g_{fs}$ | Forward Transconductance | 5.4 | — | — | S | $V_{DS}$=100V, $I_D$=3.6A ④ |
| $I_{DSS}$ | Drain-to-Source Leakage Current | — | — | 100 | μA | $V_{DS}$=1000V, $V_{GS}$=0V |
| | | — | — | 500 | | $V_{DS}$=800V, $V_{GS}$=0V, $T_J$=125°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 | — | — | 190 | nC | $I_D$=6.1A |
| $Q_{gs}$ | Gate-to-Source Charge | — | — | 23 | | $V_{DS}$=400V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | — | — | 110 | | $V_{GS}$=10V See Fig. 6 and 13 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 19 | — | ns | $V_{DD}$=500V |
| $t_r$ | Rise Time | — | 35 | — | | $I_D$=6.1A |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 130 | — | | $R_G$=6.2Ω |
| $t_f$ | Fall Time | — | 36 | — | | $R_D$=81Ω See Figure 10 ④ |
| $L_D$ | Internal Drain Inductance | — | 5.0 | — | nH | Between lead, 6 mm (0.25in.) from package and center of die contact |
| $L_S$ | Internal Source Inductance | — | 13 | — | | |
| $C_{iss}$ | Input Capacitance | — | 2800 | — | pF | $V_{GS}$=0V |
| $C_{oss}$ | Output Capacitance | — | 250 | — | | $V_{DS}$=25V |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 84 | — | | $f$=1.0MHz See Figure 5 |

## Source-Drain Ratings and Characteristics



| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | — | — | 6.1 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | — | — | 24 | | |
| $V_{SD}$ | Diode Forward Voltage | — | — | 1.8 | V | $T_J$=25°C, $I_S$=6.1A, $V_{GS}$=0V ④ |
| $t_{rr}$ | Reverse Recovery Time | — | 630 | 950 | ns | $T_J$=25°C, $I_F$=6.1A |
| $Q_{rr}$ | Reverse Recovery Charge | — | 3.5 | 5.3 | μC | di/dt=100A/μs ④ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is neglegible (turn-on is dominated by $L_S$+$L_D$) | | | | |

Notes:

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

② $V_{DD}$=50V, starting $T_J$=25°C, L=40mH $R_G$=25Ω, $I_{AS}$=6.1A (See Figure 12)

③ $I_{SD}$≤6.1A, di/dt≤120A/μs, $V_{DD}$≤600 , $T_J$≤150°C

④ Pulse width ≤ 300 μs; duty cycle ≤2%.

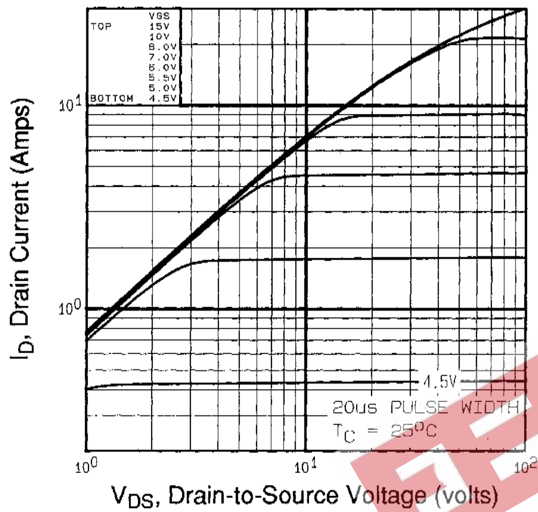



**Fig 1.** Typical Output Characteristics

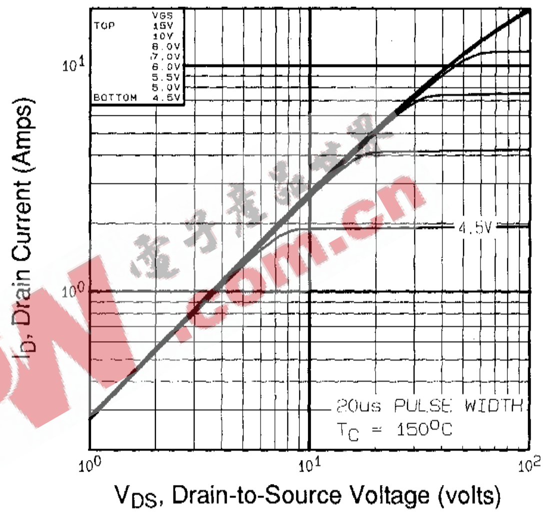



**Fig 2.** Typical Output Characteristics

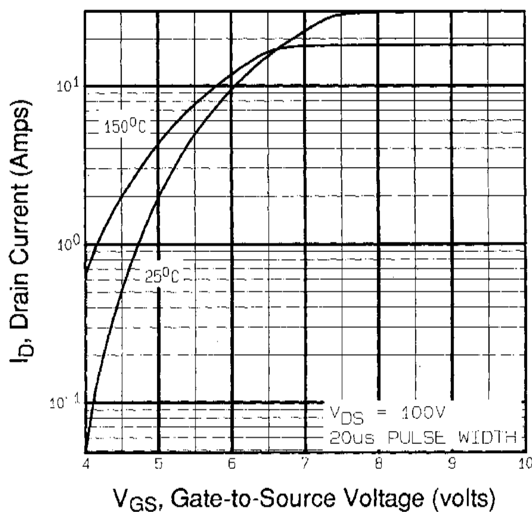



**Fig 3.** Typical Transfer Characteristics

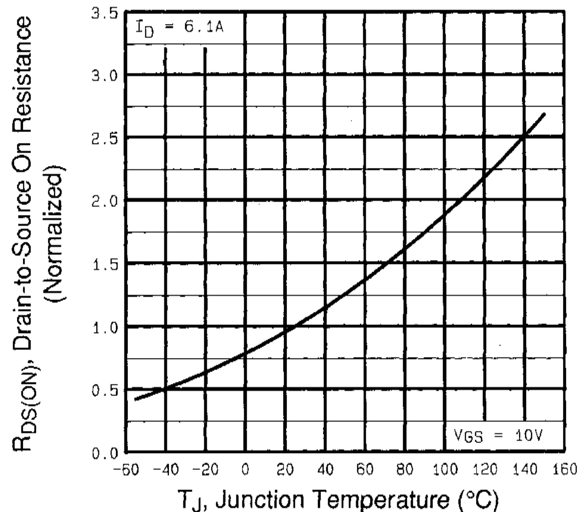



**Fig 4.** Normalized On-Resistance Vs. Temperature

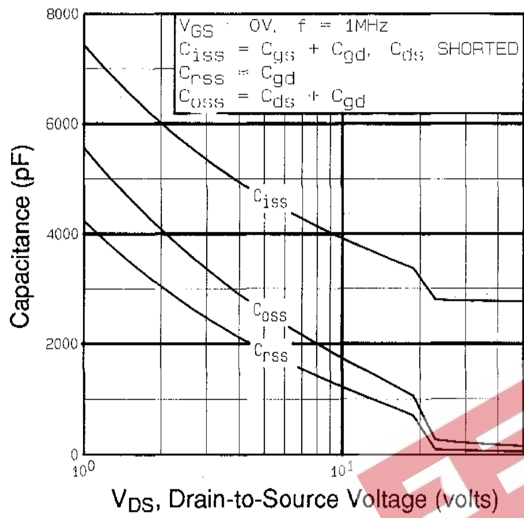



**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage

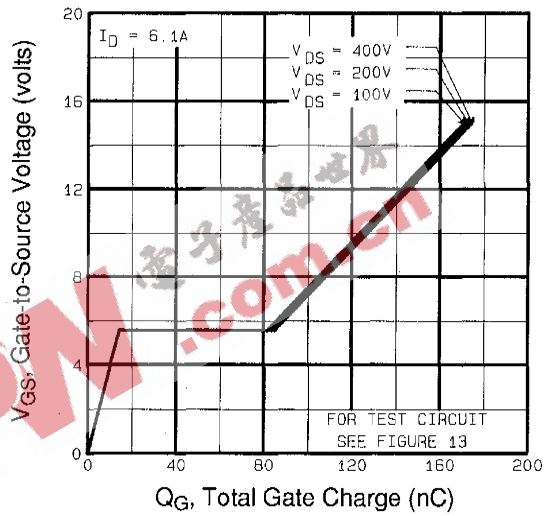



**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage

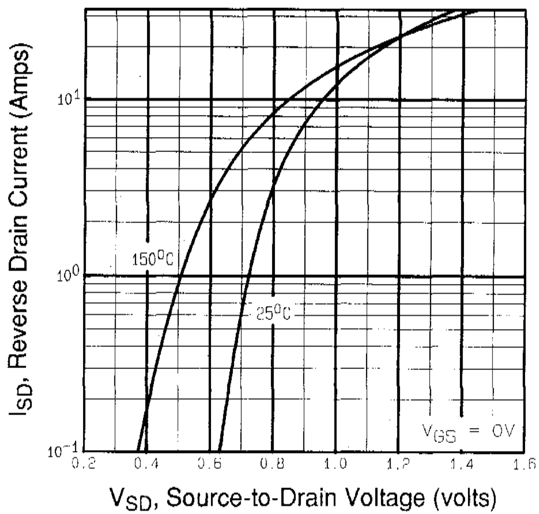



**Fig 7.** Typical Source-Drain Diode Forward Voltage

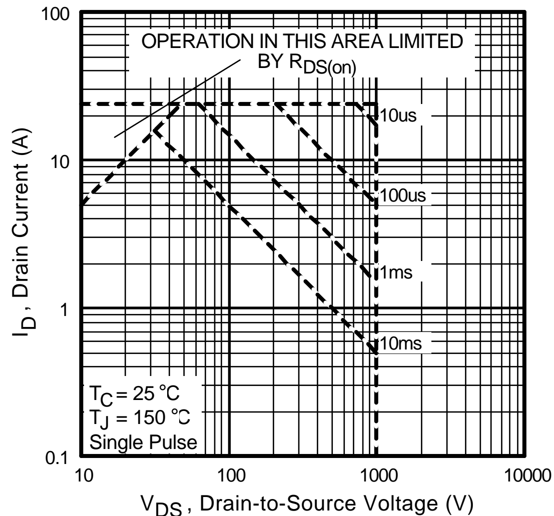



**Fig 8.** Maximum Safe Operating Area

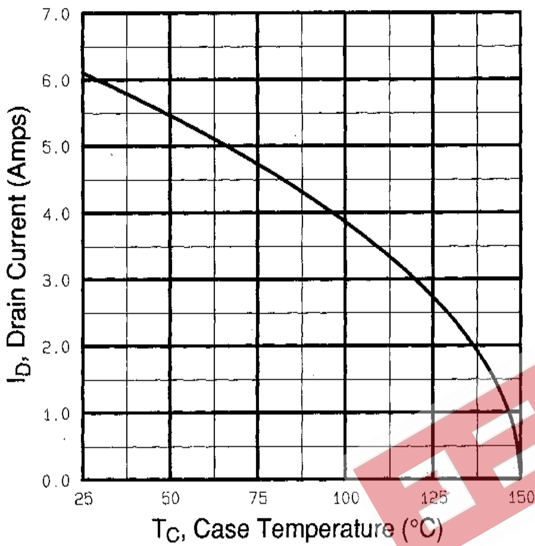



**Fig 9.** Maximum Drain Current Vs. Case Temperature

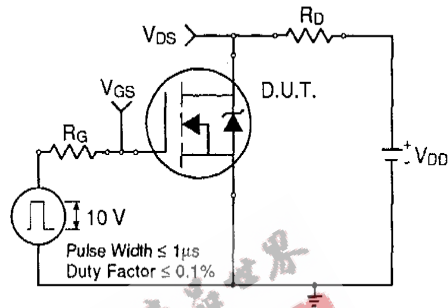



**Fig 10a.** Switching Time Test Circuit

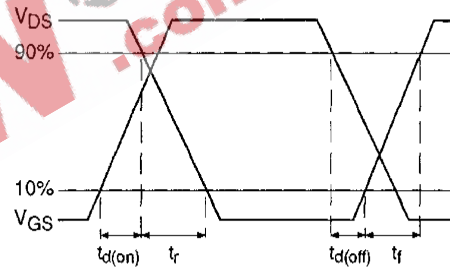



**Fig 10b.** Switching Time Waveforms

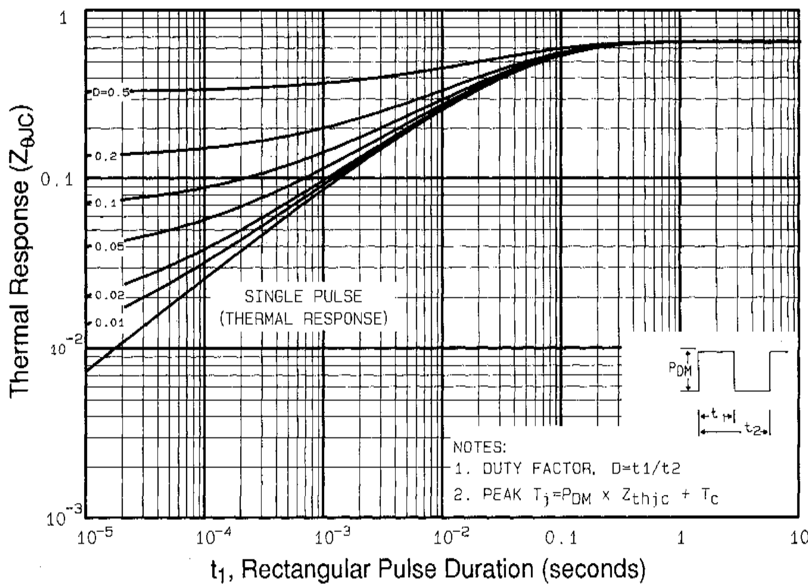



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

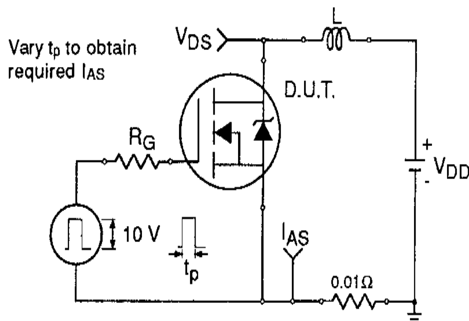



Fig 12a. Unclamped Inductive Test Circuit

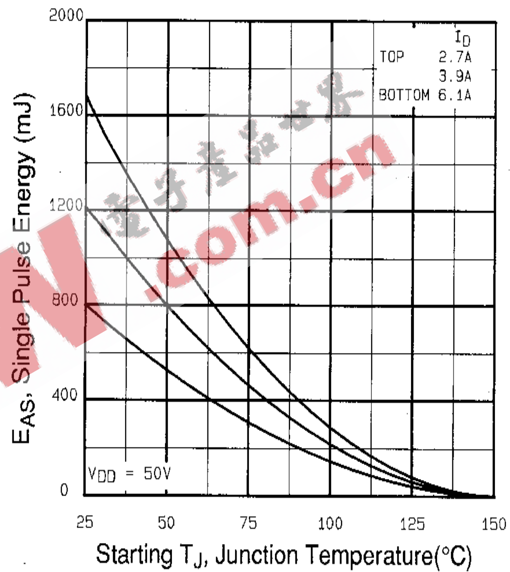



Fig 12c. Maximum Avalanche Energy Vs. Drain Current

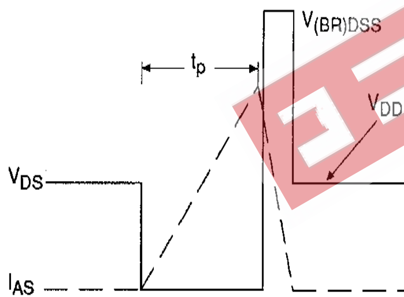



Fig 12b. Unclamped Inductive Waveforms

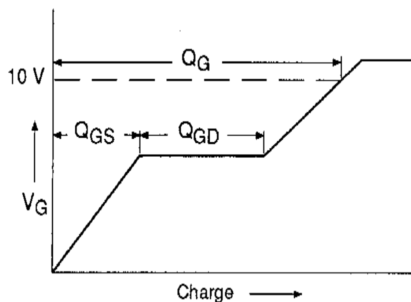



Fig 13a. Basic Gate Charge Waveform

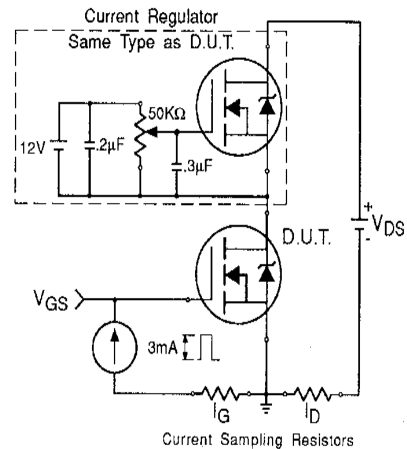
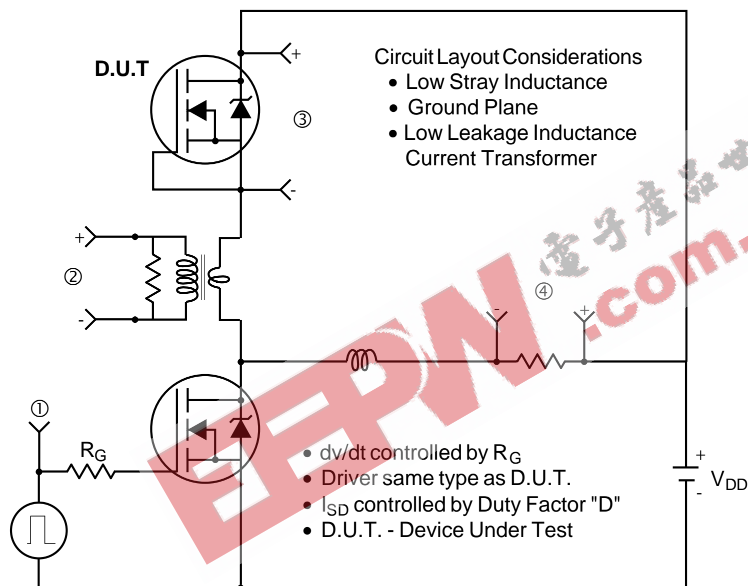



Fig 13b. Gate Charge Test Circuit

## Peak Diode Recovery dv/dt Test Circuit

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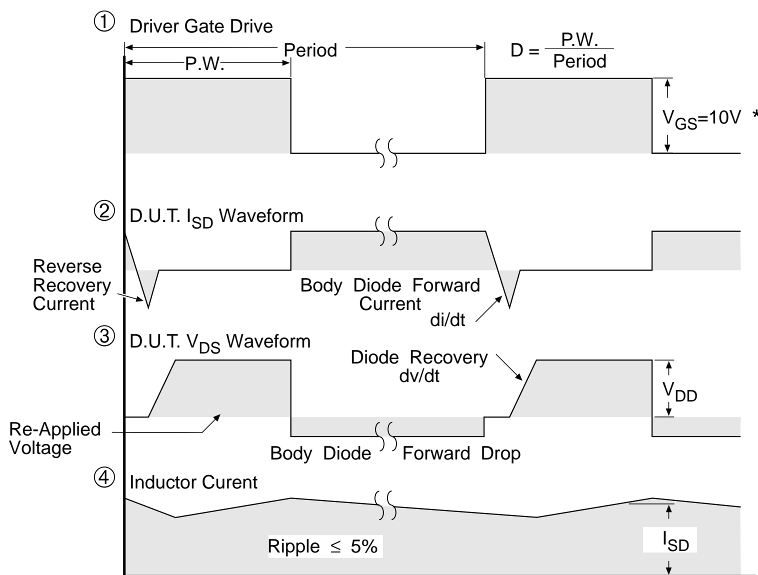
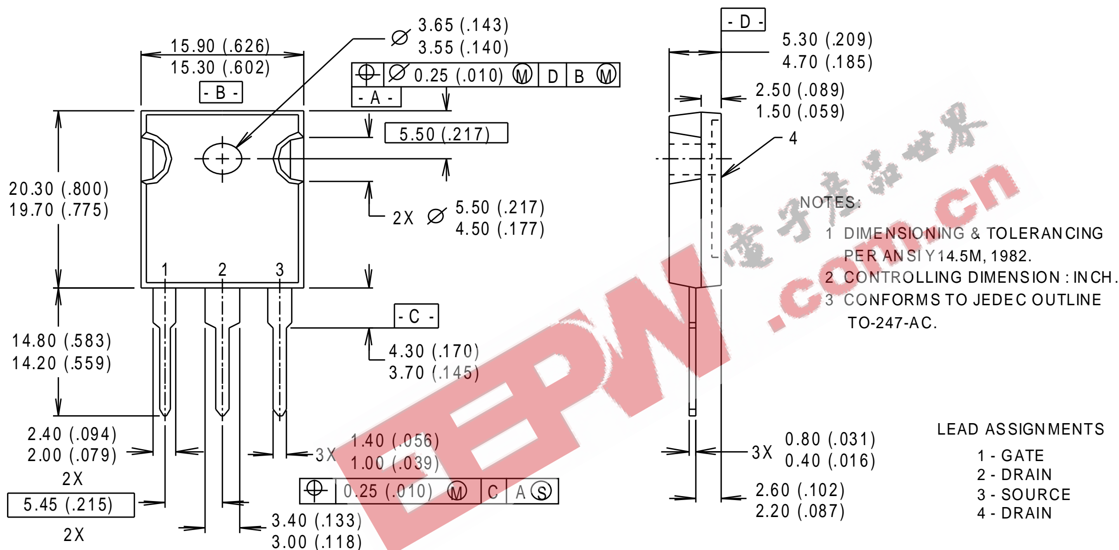


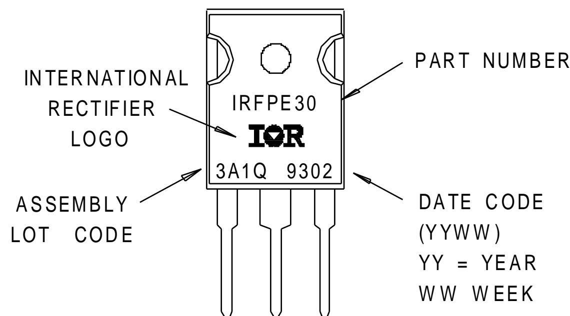

* $V_{GS}$ = 5V for Logic Level Devices

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

## TO-247AC Package Details




## Part Marking

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*Data and specifications subject to change without notice.* *10/97*