PD - 94322A

International
IOR Rectifier

# IRFP17N50L

## SMPS MOSFET

HEXFET® Power MOSFET

### Applications

- Zero Voltage Switching SMPS
- Telecom and Server Power Supplies
- Uninterruptible Power Supplies
- Motor Control applications

| $V_{DSS}$ | $R_{DS(on)}$ typ. | Trr typ. | $I_D$ |
|---|---|---|---|
| 500V | 0.28Ω | 170ns | 16A |

### Features and Benefits

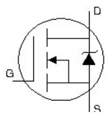
- SuperFast body diode eliminates the need for external diodes in ZVS applications.
- Lower Gate charge results in simpler drive requirements.
- Enhanced dv/dt capabilities offer improved ruggedness.
- Higher Gate voltage threshold offers improved noise immunity.

TO-247AC

### Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 16 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 11 | |
| $I_{DM}$ | Pulsed Drain Current ① | 64 | |
| $P_D$ @$T_C$ = 25°C | Power Dissipation | 220 | W |
| | Linear Derating Factor | 1.8 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 30 | V |
| dv/dt | Peak Diode Recovery dv/dt ③ | 13 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction and Storage Temperature Range | -55 to + 150 | °C |
| | Soldering Temperature, for 10 seconds | 300 (1.6mm from case ) | |
| | Mounting torque, 6-32 or M3 screw | 10lb·in (1.1N·m) | |

### Diode Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | ––– | ––– | 16 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | ––– | ––– | 64 | | |
| $V_{SD}$ | Diode Forward Voltage | ––– | ––– | 1.5 | V | $T_J$ = 25°C, $I_S$ = 16A, $V_{GS}$ = 0V ④ |
| $t_{rr}$ | Reverse Recovery Time | ––– | 170 | 250 | ns | $T_J$ = 25°C, $I_F$ = 16A |
| | | ––– | 220 | 330 | | $T_J$ = 125°C, di/dt = 100A/µs ④ |
| $Q_{rr}$ | Reverse Recovery Charge | ––– | 470 | 710 | nC | $T_J$ = 25°C, $I_S$ = 16A, $V_{GS}$ = 0V ④ |
| | | ––– | 810 | 1210 | | $T_J$ = 125°C, di/dt = 100A/µs ④ |
| $I_{RRM}$ | Reverse Recovery Current | ––– | 7.3 | 11 | A | $T_J$ = 25°C |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

07/18/03

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

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 500 | —— | —— | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | —— | 0.60 | —— | V/°C | Reference to 25°C, $I_D$ = 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | —— | 0.28 | 0.32 | Ω | $V_{GS}$ = 10V, $I_D$ = 9.9A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 3.0 | —— | 5.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA |
| $I_{DSS}$ | Drain-to-Source Leakage Current | —— | —— | 50 | μA | $V_{DS}$ = 500V, $V_{GS}$ = 0V |
| | | —— | —— | 2.0 | mA | $V_{DS}$ = 400V, $V_{GS}$ = 0V, $T_J$ = 125°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | —— | —— | 100 | nA | $V_{GS}$ = 30V |
| | Gate-to-Source Reverse Leakage | —— | —— | -100 | | $V_{GS}$ = -30V |
| $R_G$ | Internal Gate Resistance | —— | 1.4 | —— | Ω | f = 1MHz, open drain |

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

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| gfs | Forward Transconductance | 11 | —— | —— | S | $V_{DS}$ = 50V, $I_D$ = 9.9A |
| $Q_g$ | Total Gate Charge | —— | —— | 130 | nC | $I_D$ = 16A |
| $Q_{gs}$ | Gate-to-Source Charge | —— | —— | 33 | | $V_{DS}$ = 400V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | —— | —— | 59 | | $V_{GS}$ = 10V, See Fig. 7 & 15 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | —— | 21 | —— | ns | $V_{DD}$ = 250V |
| $t_r$ | Rise Time | —— | 51 | —— | | $I_D$ = 16A |
| $t_{d(off)}$ | Turn-Off Delay Time | —— | 50 | —— | | $R_G$ = 7.5Ω |
| $t_f$ | Fall Time | —— | 28 | —— | | $V_{GS}$ = 10V, See Fig. 14a & 14b ④ |
| $C_{iss}$ | Input Capacitance | —— | 2760 | —— | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | —— | 325 | —— | | $V_{DS}$ = 25V |
| $C_{rss}$ | Reverse Transfer Capacitance | —— | 37 | —— | | $f$ = 1.0MHz, See Fig. 5 |
| $C_{oss}$ | Output Capacitance | —— | 3690 | —— | | $V_{GS}$ = 0V, $V_{DS}$ = 1.0V, $f$ = 1.0MHz |
| $C_{oss}$ | Output Capacitance | —— | 84 | —— | | $V_{GS}$ = 0V, $V_{DS}$ = 400V, $f$ = 1.0MHz |
| $C_{oss}$ eff. | Effective Output Capacitance | —— | 159 | —— | | $V_{GS}$ = 0V,$V_{DS}$ = 0V to 400V ⑤ |
| $C_{oss}$ eff. (ER) | Effective Output Capacitance (Energy Related) | —— | 120 | —— | | |

## Avalanche Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $E_{AS}$ | Single Pulse Avalanche Energy② | —— | 390 | mJ |
| $I_{AR}$ | Avalanche Current ① | —— | 16 | A |
| $E_{AR}$ | Repetitive Avalanche Energy ① | —— | 22 | mJ |

## Thermal Resistance

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | —— | 0.56 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.50 | —— | |
| $R_{\theta JA}$ | Junction-to-Ambient | —— | 62 | |

**Notes:**

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

② Starting $T_J$ = 25°C, L = 3.0mH, $R_G$ = 25Ω, $I_{AS}$ = 16A. (See Figure 12).

③ $I_{SD}$ = 16A, di/dt ≤ 347A/μs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 150°C.

④ Pulse width ≤ 300μs; duty cycle ≤ 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% $V_{DSS}$.
$C_{oss}$ eff.(ER) is a fixed capacitance that stores the same energy as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$.

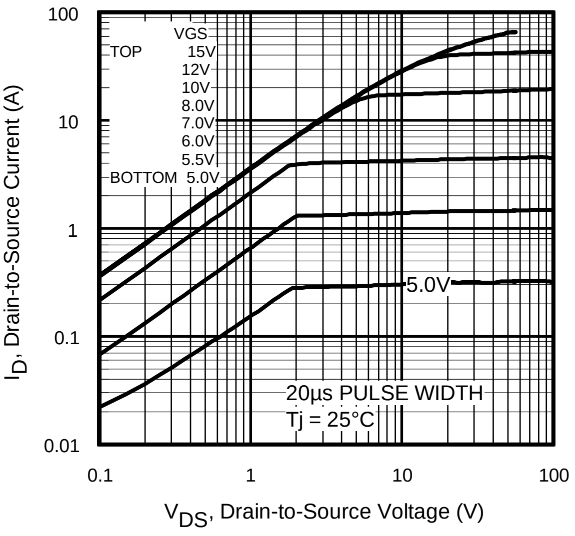


**Fig 1.** Typical Output Characteristics

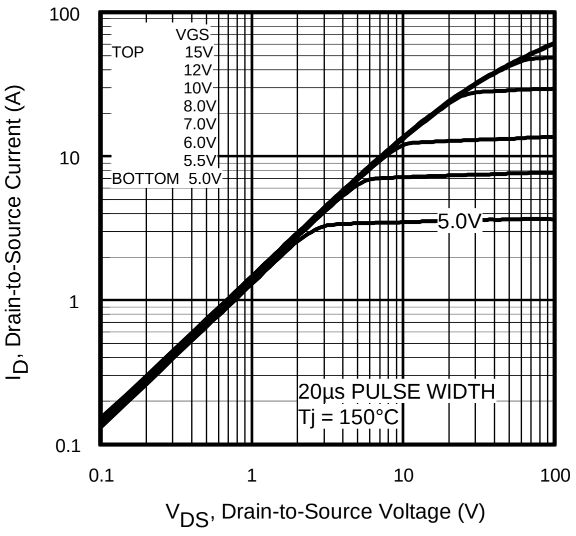


**Fig 2.** Typical Output Characteristics

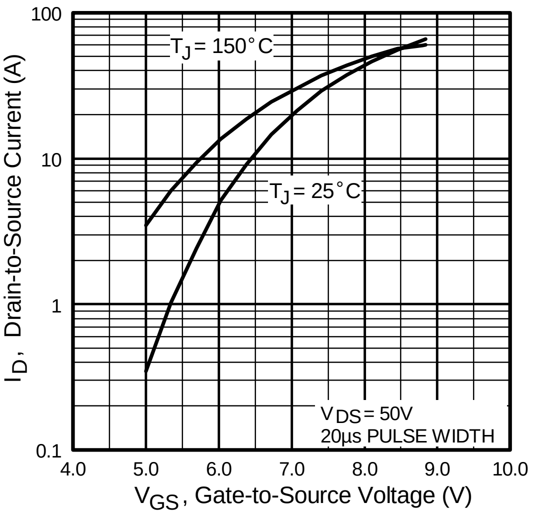


**Fig 3.** Typical Transfer Characteristics

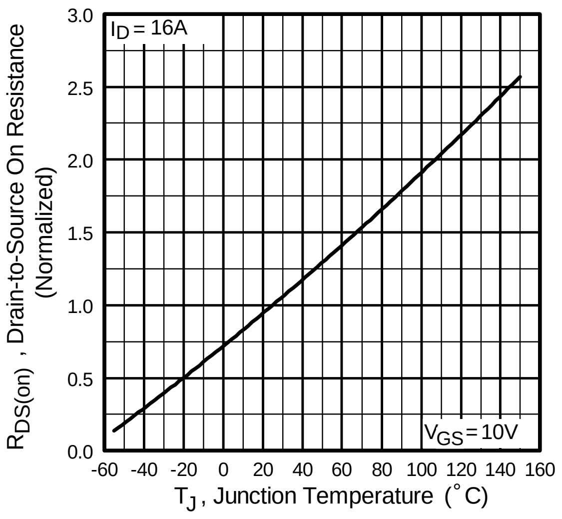


**Fig 4.** Normalized On-Resistance
Vs. Temperature

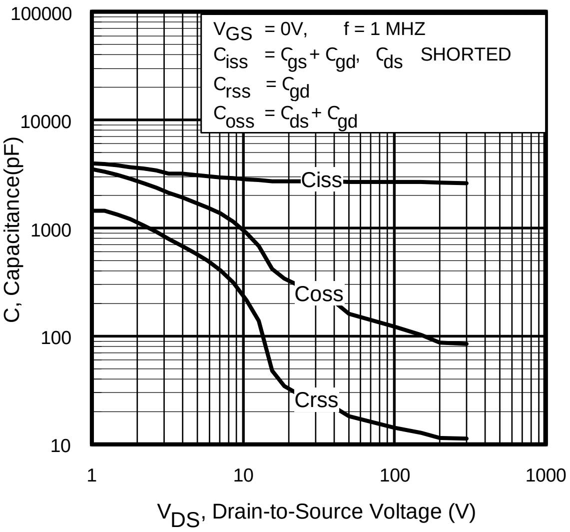


**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage

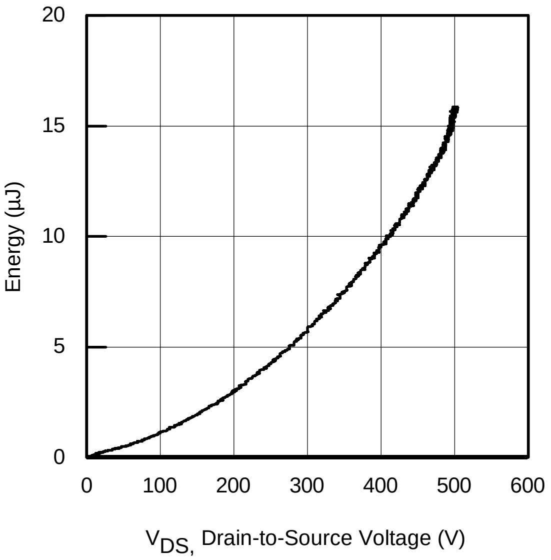


**Fig 6.** Typ. Output Capacitance Stored Energy vs. $V_{DS}$

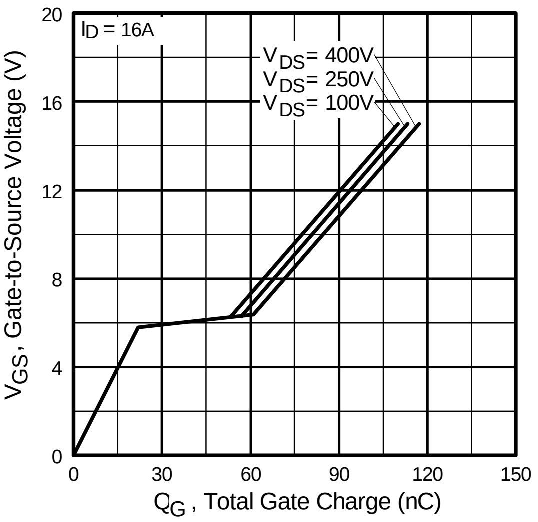


**Fig 7.** Typical Gate Charge Vs. Gate-to-Source Voltage

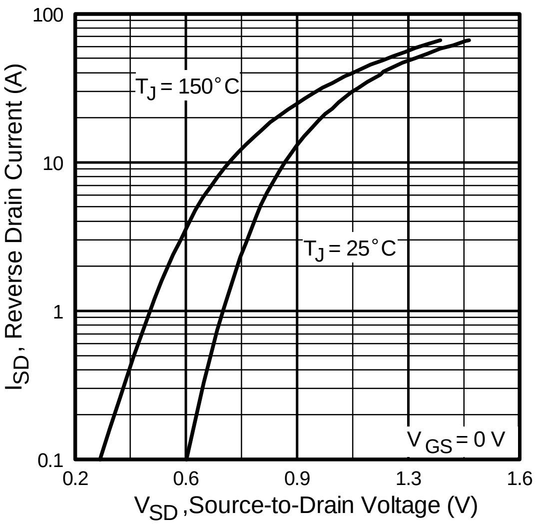


**Fig 8.** Typical Source-Drain Diode Forward Voltage

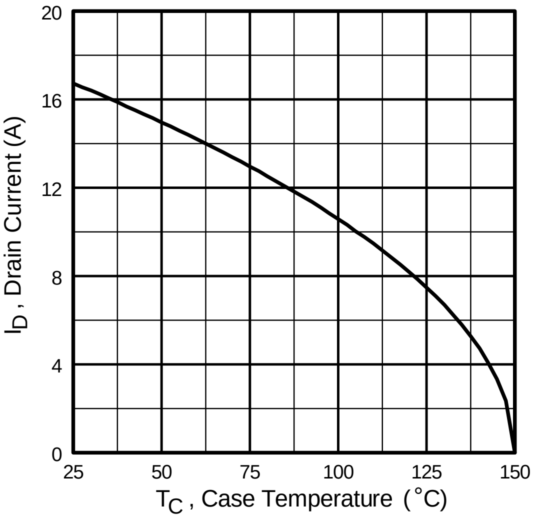


**Fig 9.** Maximum Drain Current Vs. Case Temperature

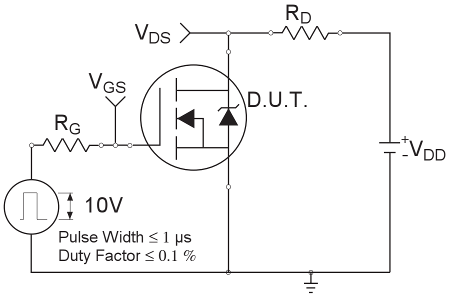


**Fig 10a.** Switching Time Test Circuit

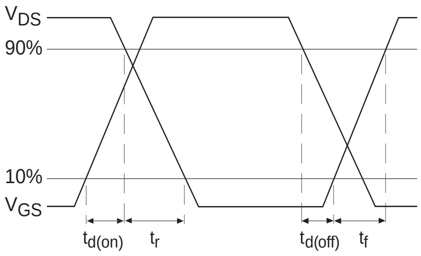


**Fig 10b.** Switching Time Waveforms

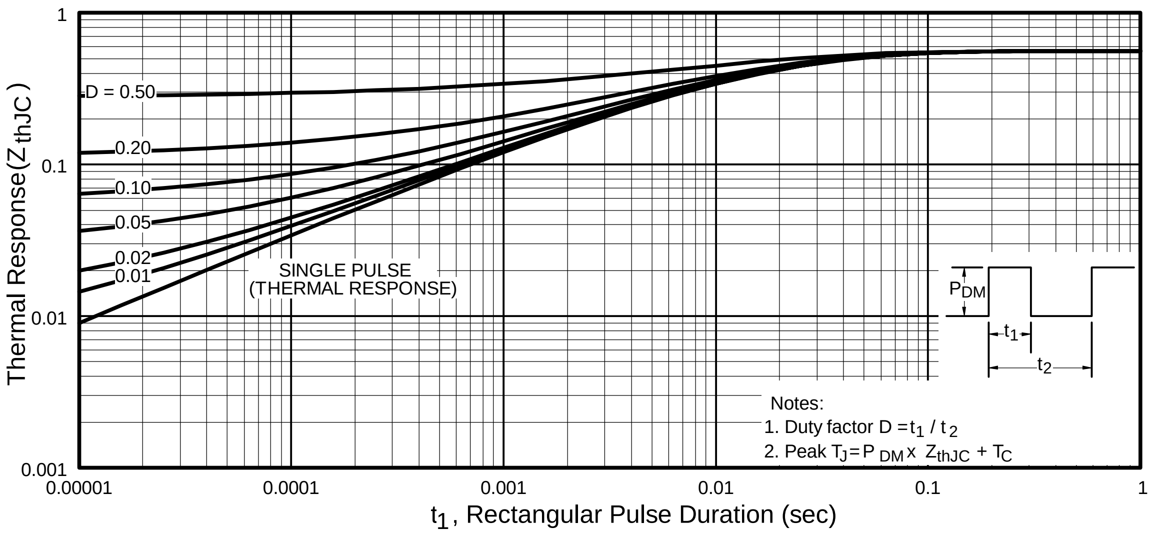


**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

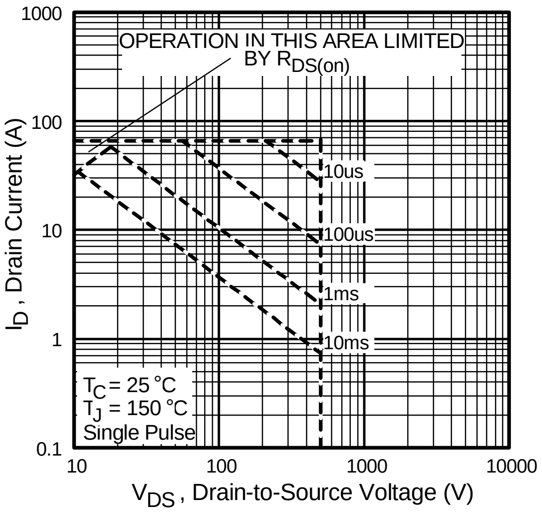


**Fig 12.** Maximum Safe Operating Area

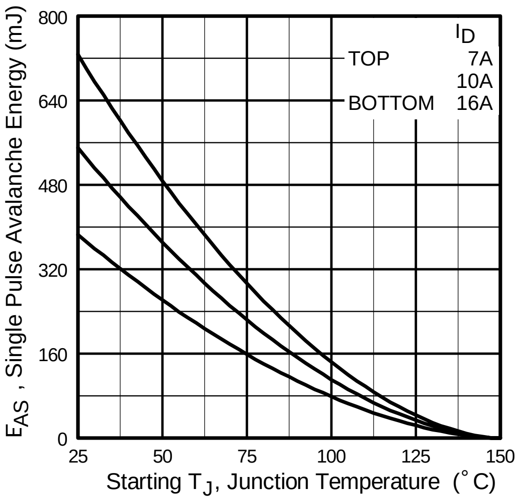


**Fig 13.** Maximum Avalanche Energy vs. Drain Current

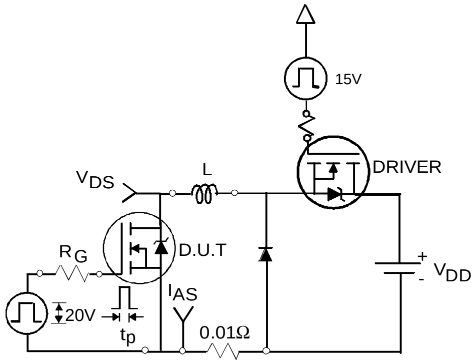


**Fig 14a.** Unclamped Inductive Test Circuit

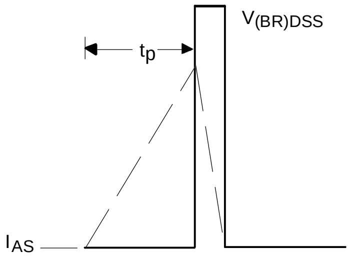


**Fig 14b.** Unclamped Inductive Waveforms

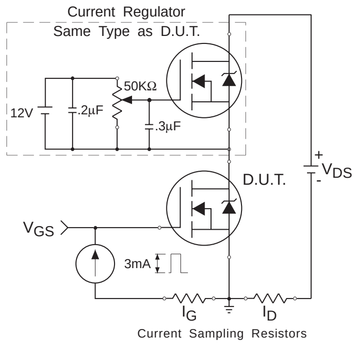


**Fig 15a.** Gate Charge Test Circuit

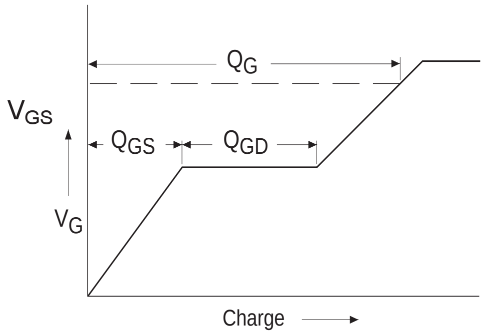
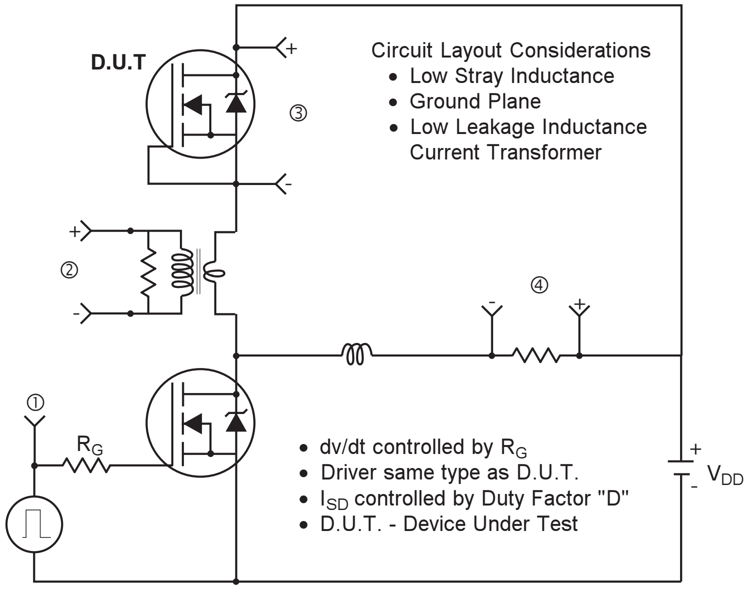


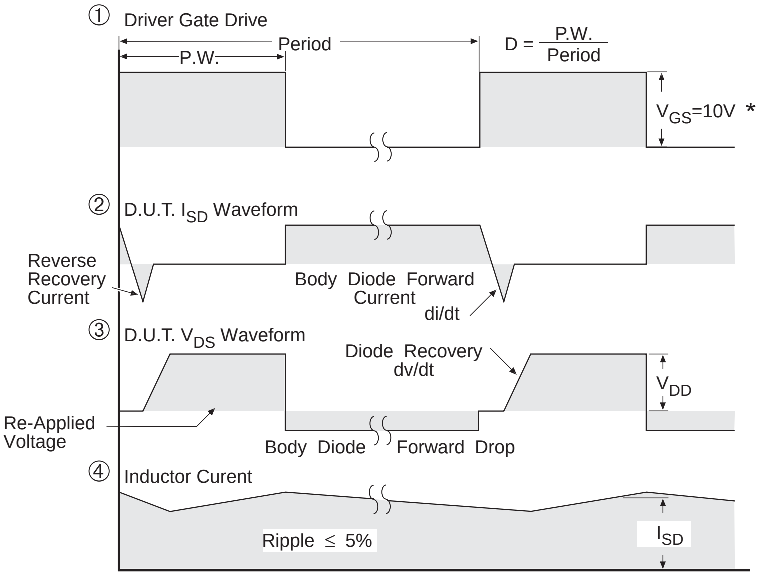
**Fig 15b.** Basic Gate Charge Waveform

## Peak Diode Recovery dv/dt Test Circuit



Circuit Layout Considerations
- Low Stray Inductance
- Ground Plane
- Low Leakage Inductance Current Transformer

- dv/dt controlled by $R_G$
- Driver same type as D.U.T.
- $I_{SD}$ controlled by Duty Factor "D"
- D.U.T. - Device Under Test

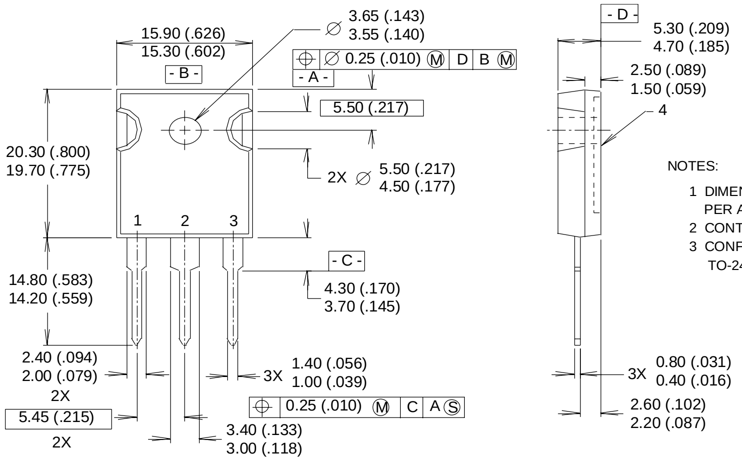


* $V_{GS}$ = 5V for Logic Level Devices

**Fig 16.** For N-Channel HEXFET® Power MOSFETs

## TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
2 CONTROLLING DIMENSION : INCH.
3 CONFORMS TO JEDEC OUTLINE TO-247-AC.

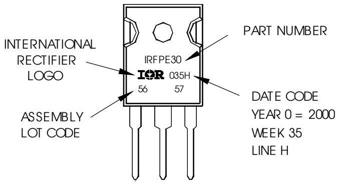
LEAD ASSIGNMENTS

1 - GATE
2 - DRAIN
3 - SOURCE
4 - DRAIN

## TO-247AC Part Marking Information

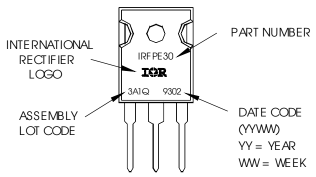
Notes : This part marking information applies to devices produced after 02/26/2001

EXAMPLE: THIS IS AN IRFPE30
WITH ASSEMBLY
LOT CODE 5657
ASSEMBLED ON WW 35, 2000
IN THE ASSEMBLY LINE "H"



Notes : This part marking information applies to devices produced before 02/26/2001 or for parts manufactured in GB.

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



**TO-247AC package is not recommended for Surface Mount Application.**

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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