

**Applications**

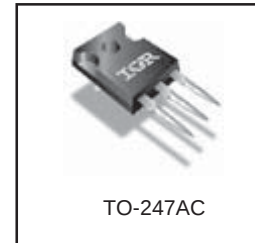
- Zero Voltage Switching SMPS
- Telecom and Server Power Supplies
- Uninterruptible Power Supplies
- Motor Control applications

HEXFET® Power MOSFET

| $V_{DS}$ | $R_{DS(on)}$ typ. | $T_{rr}$ typ. | $I_D$ |
|----------|-------------------|---------------|-------|
| 600V     | 385mΩ             | 130ns         | 15A   |

**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.



**Absolute Maximum Ratings**

|                                   | Parameter                                           | Max.                   | Units        |
|-----------------------------------|-----------------------------------------------------|------------------------|--------------|
| $I_D$ @ $T_C = 25^\circ\text{C}$  | Continuous Drain Current, $V_{GS}$ @ 10V            | 15                     | A            |
| $I_D$ @ $T_C = 100^\circ\text{C}$ | Continuous Drain Current, $V_{GS}$ @ 10V            | 9.7                    |              |
| $I_{DM}$                          | Pulsed Drain Current ①                              | 60                     |              |
| $P_D$ @ $T_C = 25^\circ\text{C}$  | Power Dissipation                                   | 280                    | W            |
|                                   | Linear Derating Factor                              | 2.3                    | W/°C         |
| $V_{GS}$                          | Gate-to-Source Voltage                              | ±30                    | V            |
| dv/dt                             | Peak Diode Recovery dv/dt ②                         | 10                     | 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                   | 1.1(10)                | N•m (lbf•in) |

**Diode Characteristics**

| Symbol    | Parameter                                 | Min.                                                                 | Typ. | Max. | Units | Conditions                                                              |
|-----------|-------------------------------------------|----------------------------------------------------------------------|------|------|-------|-------------------------------------------------------------------------|
| $I_S$     | Continuous Source Current<br>(Body Diode) | —                                                                    | —    | 15   | A     | MOSFET symbol<br>showing the<br>integral reverse<br>p-n junction diode. |
| $I_{SM}$  | Pulsed Source Current<br>(Body Diode) ①   | —                                                                    | —    | 60   |       |                                                                         |
| $V_{SD}$  | Diode Forward Voltage                     | —                                                                    | —    | 1.5  | V     | $T_J = 25^\circ\text{C}$ , $I_S = 15\text{A}$ , $V_{GS} = 0\text{V}$ ④  |
| $t_{rr}$  | Reverse Recovery Time                     | —                                                                    | 130  | 200  | ns    | $T_J = 25^\circ\text{C}$ , $I_F = 15\text{A}$                           |
|           |                                           | —                                                                    | 240  | 360  |       | $T_J = 125^\circ\text{C}$ , $di/dt = 100\text{A}/\mu\text{s}$ ④         |
| $Q_{rr}$  | Reverse Recovery Charge                   | —                                                                    | 450  | 670  | nC    | $T_J = 25^\circ\text{C}$ , $I_S = 15\text{A}$ , $V_{GS} = 0\text{V}$ ④  |
|           |                                           | —                                                                    | 1080 | 1620 |       | $T_J = 125^\circ\text{C}$ , $di/dt = 100\text{A}/\mu\text{s}$ ④         |
| $I_{RRM}$ | Reverse Recovery Current                  | —                                                                    | 5.8  | 8.7  | A     | $T_J = 25^\circ\text{C}$                                                |
| $t_{on}$  | Forward Turn-On Time                      | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) |      |      |       |                                                                         |

# IRFP15N60L

International  
IR Rectifier

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

| Symbol                          | Parameter                            | Min. | Typ. | Max. | Units      | Conditions                                            |
|---------------------------------|--------------------------------------|------|------|------|------------|-------------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 600  | —    | —    | V          | $V_{GS} = 0V, I_D = 250\mu A$                         |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.39 | —    | V/°C       | Reference to $25^\circ\text{C}$ , $I_D = 1mA$         |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | 385  | 460  | m $\Omega$ | $V_{GS} = 10V, I_D = 9.0A$ 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      | —    | —    | 50   | $\mu A$    | $V_{DS} = 600V, V_{GS} = 0V$                          |
|                                 |                                      | —    | —    | 2.0  | mA         | $V_{DS} = 480V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —    | 100  | nA         | $V_{GS} = 30V$                                        |
|                                 | Gate-to-Source Reverse Leakage       | —    | —    | -100 | nA         | $V_{GS} = -30V$                                       |
| $R_G$                           | Internal Gate Resistance             | —    | 0.79 | —    | $\Omega$   | $f = 1MHz$ , open drain                               |

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

| Symbol                      | Parameter                                     | Min. | Typ. | Max. | Units | Conditions                                    |
|-----------------------------|-----------------------------------------------|------|------|------|-------|-----------------------------------------------|
| $g_{fs}$                    | Forward Transconductance                      | 8.3  | —    | —    | S     | $V_{DS} = 50V, I_D = 9.0A$                    |
| $Q_g$                       | Total Gate Charge                             | —    | —    | 100  | nC    | $I_D = 15A$                                   |
| $Q_{gs}$                    | Gate-to-Source Charge                         | —    | —    | 30   | nC    | $V_{DS} = 480V$                               |
| $Q_{gd}$                    | Gate-to-Drain ("Miller") Charge               | —    | —    | 46   | nC    | $V_{GS} = 10V$ , See Fig. 7 & 15 ④            |
| $t_{d(on)}$                 | Turn-On Delay Time                            | —    | 20   | —    | ns    | $V_{DD} = 300V$                               |
| $t_r$                       | Rise Time                                     | —    | 44   | —    |       | $I_D = 15A$                                   |
| $t_{d(off)}$                | Turn-Off Delay Time                           | —    | 28   | —    |       | $R_G = 1.8\Omega$                             |
| $t_f$                       | Fall Time                                     | —    | 5.5  | —    |       | $V_{GS} = 10V$ , See Fig. 11a & 11b ④         |
| $C_{iss}$                   | Input Capacitance                             | —    | 2720 | —    | pF    | $V_{GS} = 0V$                                 |
| $C_{oss}$                   | Output Capacitance                            | —    | 260  | —    |       | $V_{DS} = 25V$                                |
| $C_{rss}$                   | Reverse Transfer Capacitance                  | —    | 20   | —    |       | $f = 1.0MHz$ , See Fig. 5                     |
| $C_{oss \text{ eff.}}$      | Effective Output Capacitance                  | —    | 120  | —    |       | $V_{GS} = 0V, V_{DS} = 0V \text{ to } 480V$ ⑤ |
| $C_{oss \text{ eff. (ER)}}$ | Effective Output Capacitance (Energy Related) | —    | 100  | —    |       |                                               |

## Avalanche Characteristics

| Symbol   | Parameter                       | Typ. | Max. | Units |
|----------|---------------------------------|------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy ② | —    | 320  | mJ    |
| $I_{AR}$ | Avalanche Current ①             | —    | 15   | A     |
| $E_{AR}$ | Repetitive Avalanche Energy ①   | —    | 28   | mJ    |

## Thermal Resistance

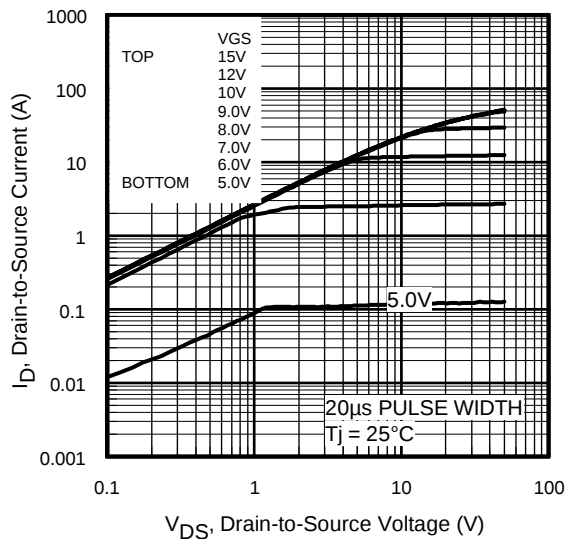
| Symbol          | Parameter                           | Typ. | Max. | Units |
|-----------------|-------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case                    | —    | 0.44 | °C/W  |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.24 | —    |       |
| $R_{\theta JA}$ | Junction-to-Ambient                 | —    | 40   |       |

### Notes:

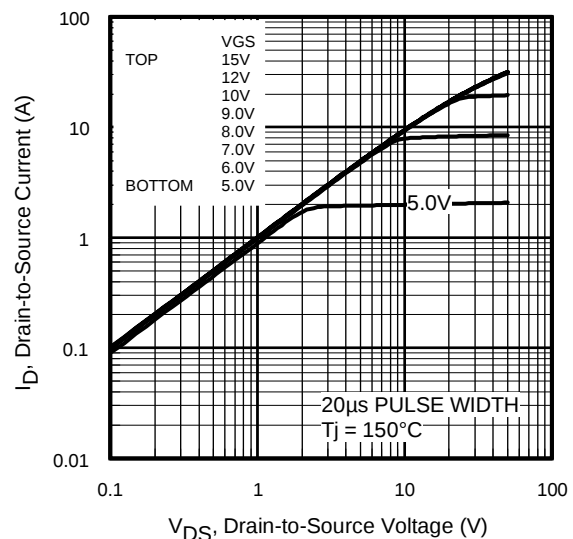
- ① Repetitive rating; pulse width limited by max. junction temperature. (See Fig. 11)
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 2.9mH$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 15A$ ,  $dv/dt = 10V/ns$ . (See Figure 12a)
- ③  $I_{SD} \leq 15A$ ,  $di/dt \leq 340A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 150^\circ\text{C}$ .

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

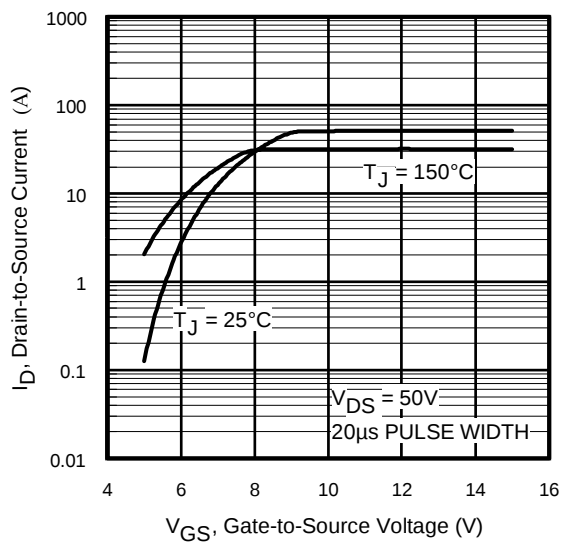
- ⑤  $C_{oss \text{ eff.}}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .  
 $C_{oss \text{ eff. (ER)}}$  is a fixed capacitance that stores the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .



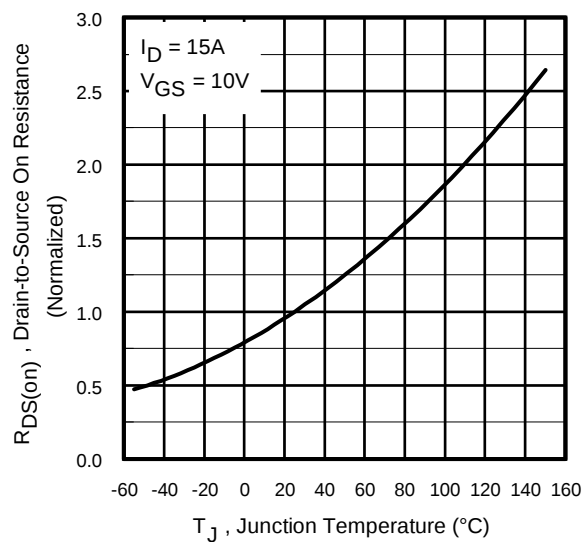
**Fig 1.** Typical Output Characteristics



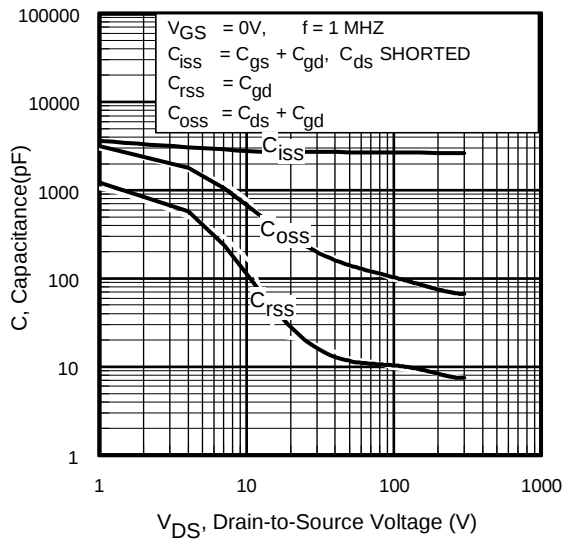
**Fig 2.** Typical Output Characteristics



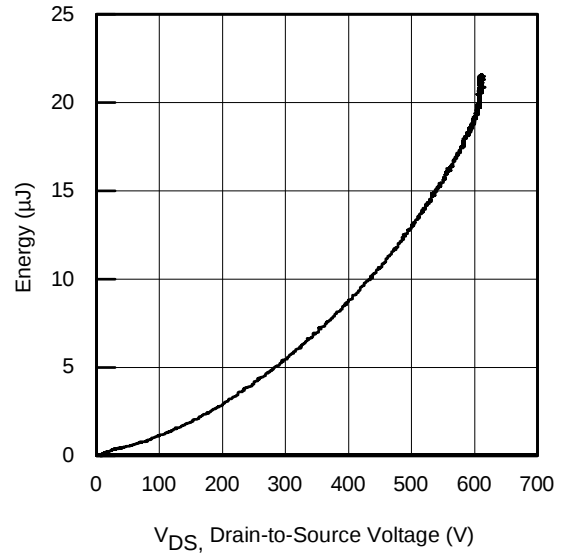
**Fig 3.** Typical Transfer Characteristics



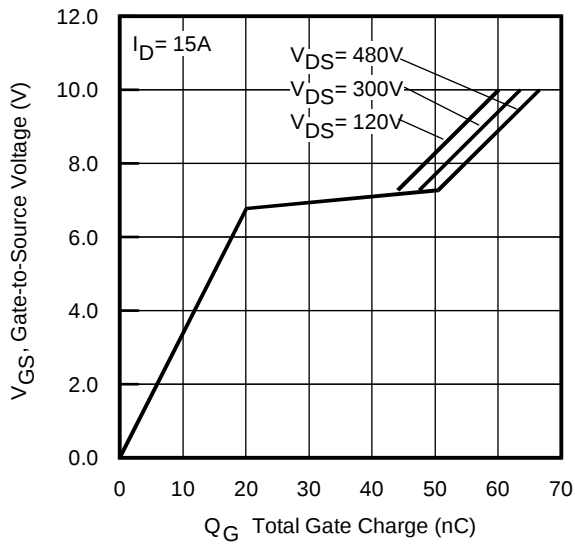
**Fig 4.** Normalized On-Resistance vs. Temperature



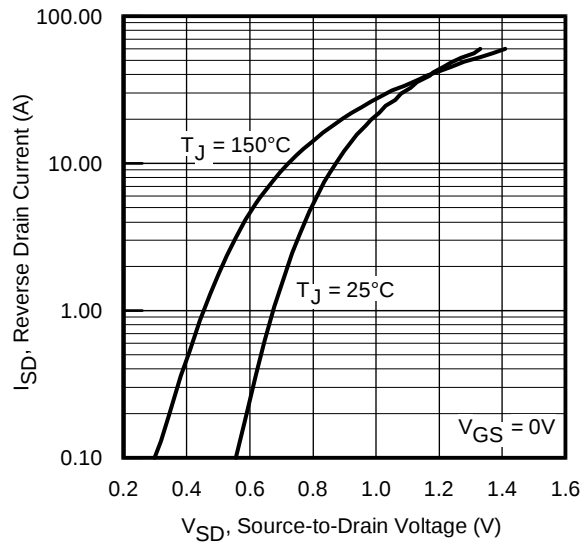
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



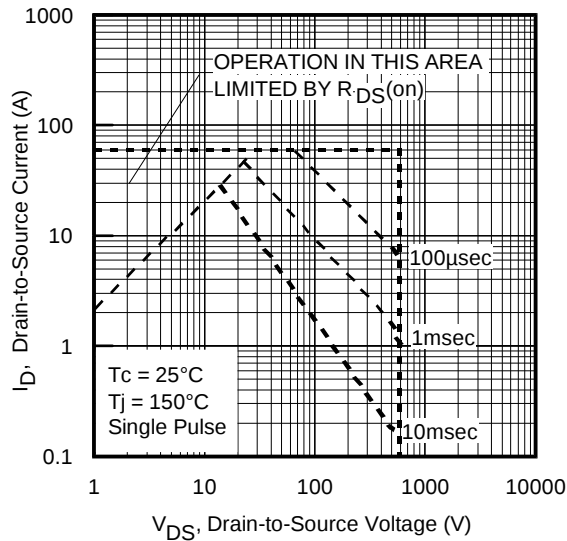
**Fig 6.** Typ. Output Capacitance Stored Energy vs.  $V_{DS}$



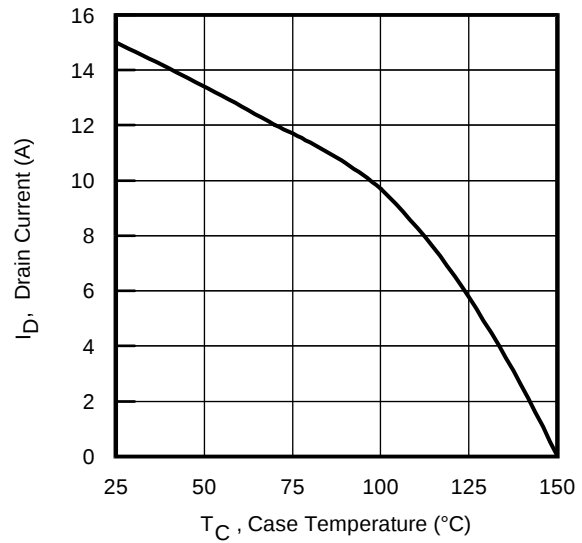
**Fig 7.** Typical Gate Charge vs. Gate-to-Source Voltage



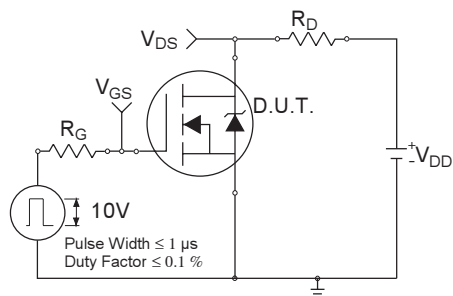
**Fig 8.** Typical Source-Drain Diode Forward Voltage



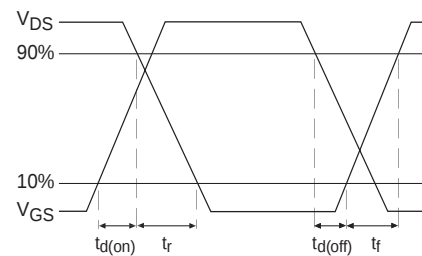
**Fig 9.** Maximum Safe Operating Area



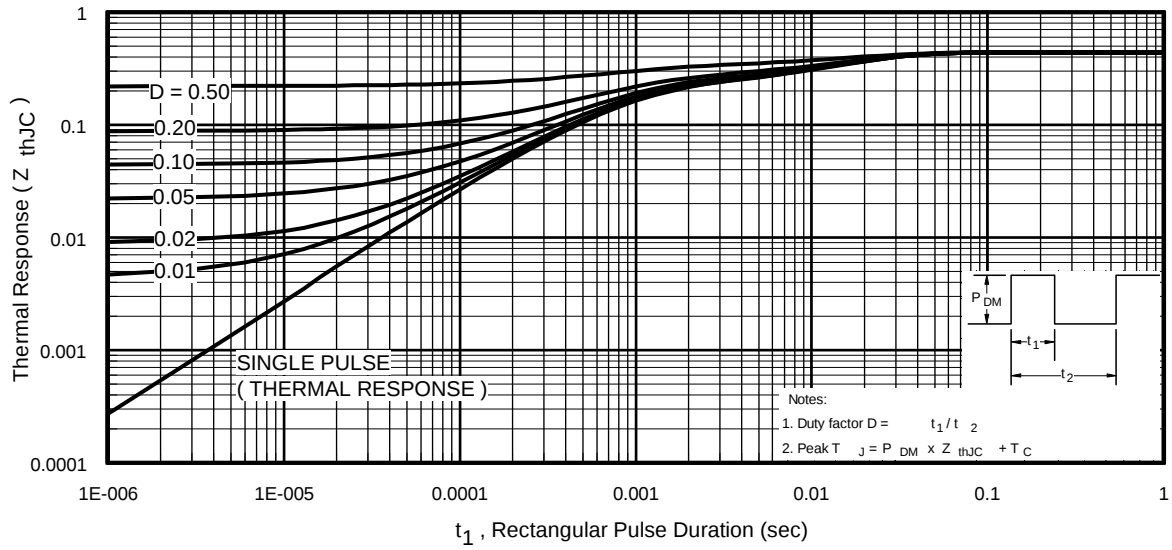
**Fig 10.** Maximum Drain Current vs. Case Temperature



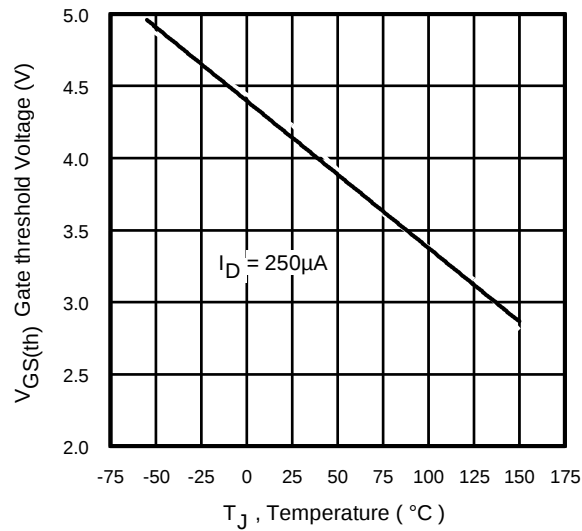
**Fig 11a.** Switching Time Test Circuit



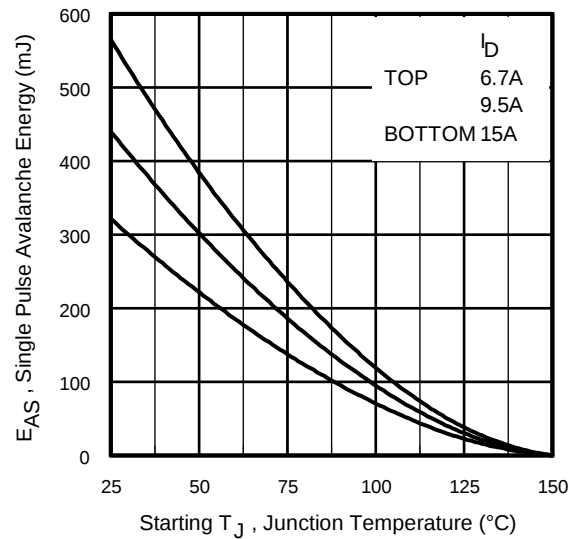
**Fig 11b.** Switching Time Waveforms



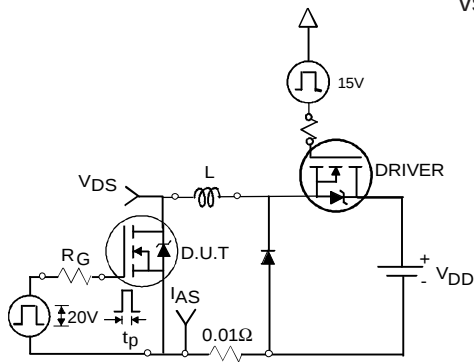
**Fig 12.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



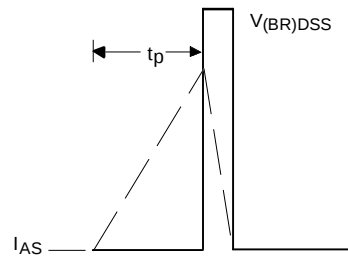
**Fig 13.** Threshold Voltage vs. Temperature



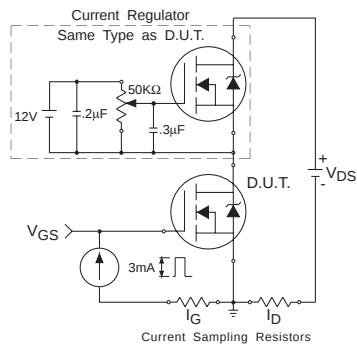
**Fig 14a.** Maximum Avalanche Energy vs. Drain Current



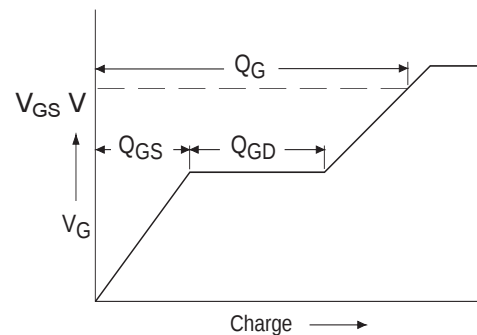
**Fig 14b.** Unclamped Inductive Test Circuit



**Fig 14c.** Unclamped Inductive Waveforms

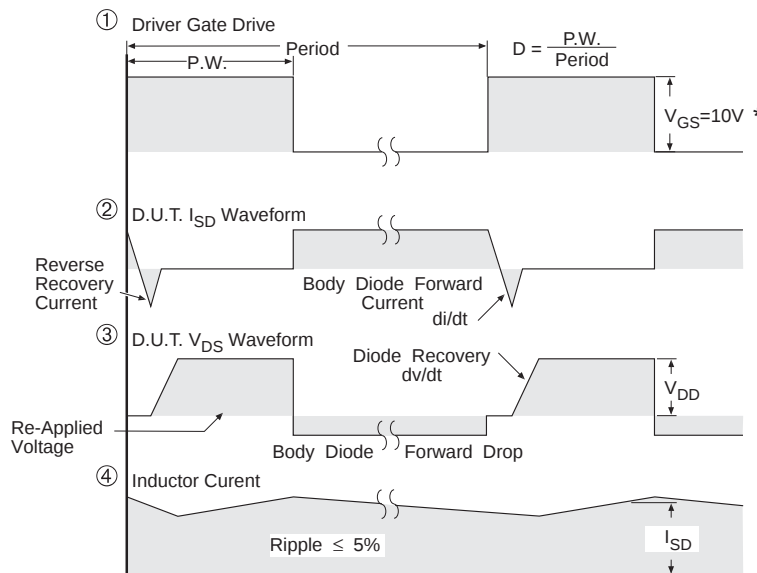
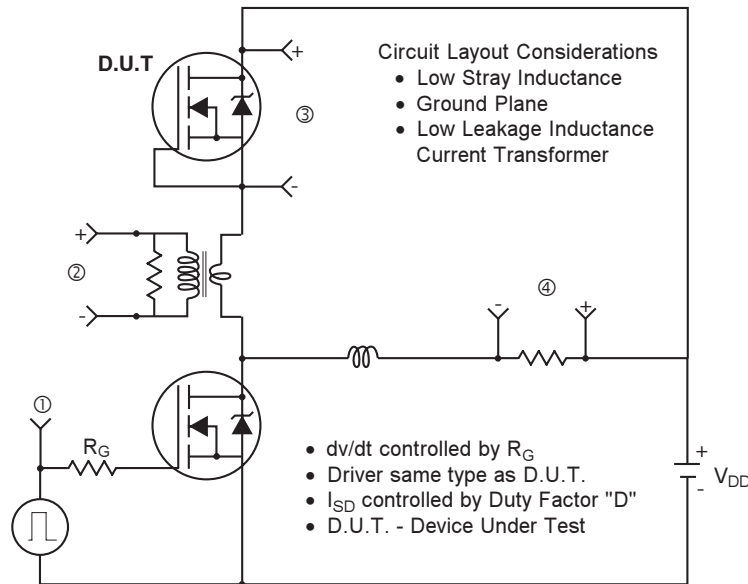


**Fig 15a.** Gate Charge Test Circuit



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

## Peak Diode Recovery $dv/dt$ Test Circuit

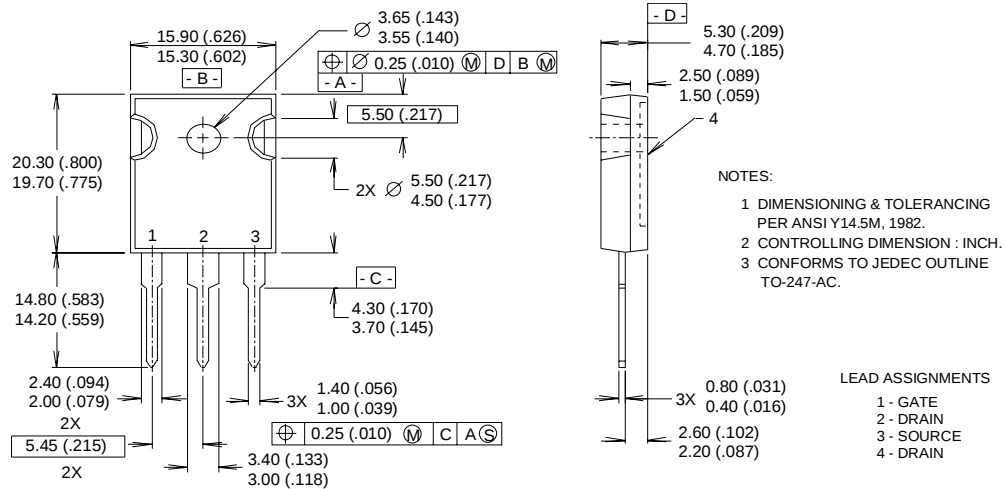


\*  $V_{GS} = 5V$  for Logic Level Devices

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

# TO-247AC Package Outline

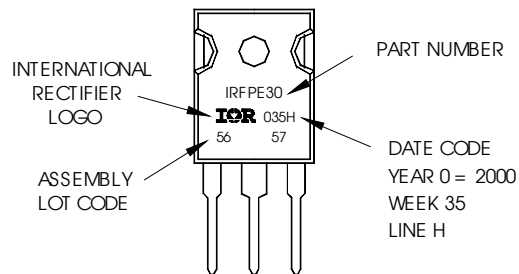
Dimensions are shown in millimeters (inches)



## 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"



**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 Industrial market.  
Qualification Standards can be found on IR's Web site.

International  
**IOR** Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
TAC Fax: (310) 252-7903

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