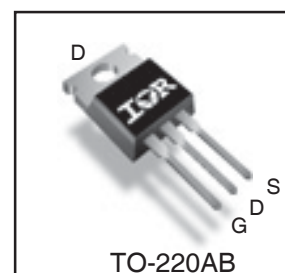
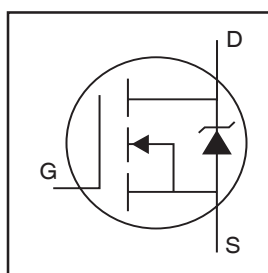


## Features

- Key Parameters Optimized for Class-D Audio Amplifier Applications
- Low  $R_{DS(ON)}$  for Improved Efficiency
- Low  $Q_G$  and  $Q_{SW}$  for Better THD and Improved Efficiency
- Low  $Q_{RR}$  for Better THD and Lower EMI
- 175°C Operating Junction Temperature for Ruggedness
- Can Deliver up to 200W per Channel into 8Ω Load in Half-Bridge Configuration Amplifier

## Key Parameters

|                         |     |    |
|-------------------------|-----|----|
| $V_{DS}$                | 150 | V  |
| $R_{DS(ON)}$ typ. @ 10V | 80  | mΩ |
| $Q_g$ typ.              | 13  | nC |
| $Q_{sw}$ typ.           | 5.1 | nC |
| $R_{G(int)}$ typ.       | 2.4 | Ω  |
| $T_J$ max               | 175 | °C |



|          |          |          |
|----------|----------|----------|
| <b>G</b> | <b>D</b> | <b>S</b> |
| Gate     | Drain    | Source   |

## Description

This Digital Audio MOSFET is specifically designed for Class-D audio amplifier applications. This MOSFET utilizes the latest processing techniques to achieve low on-resistance per silicon area. Furthermore, Gate charge, body-diode reverse recovery and internal Gate resistance are optimized to improve key Class-D audio amplifier performance factors such as efficiency, THD and EMI. Additional features of this MOSFET are 175°C operating junction temperature and repetitive avalanche capability. These features combine to make this MOSFET a highly efficient, robust and reliable device for ClassD audio amplifier applications.

## Absolute Maximum Ratings

|                                   | Parameter                                                  | Max.             | Units |
|-----------------------------------|------------------------------------------------------------|------------------|-------|
| $V_{DS}$                          | Drain-to-Source Voltage                                    | 150              | V     |
| $V_{GS}$                          | Gate-to-Source Voltage                                     | ±20              |       |
| $I_D$ @ $T_C = 25^\circ\text{C}$  | Continuous Drain Current, $V_{GS}$ @ 10V                   | 17               | A     |
| $I_D$ @ $T_C = 100^\circ\text{C}$ | Continuous Drain Current, $V_{GS}$ @ 10V                   | 12               |       |
| $I_{DM}$                          | Pulsed Drain Current ①                                     | 51               |       |
| $P_D$ @ $T_C = 25^\circ\text{C}$  | Power Dissipation ④                                        | 80               | W     |
| $P_D$ @ $T_C = 100^\circ\text{C}$ | Power Dissipation ④                                        | 40               |       |
|                                   | Linear Derating Factor                                     | 0.5              | W/°C  |
| $T_J$<br>$T_{STG}$                | Operating Junction and<br>Storage Temperature Range        | -55 to + 175     | °C    |
|                                   | Soldering Temperature, for 10 seconds<br>(1.6mm from case) | 300              |       |
|                                   | Mounting torque, 6-32 or M3 screw                          | 10lb·in (1.1N·m) |       |

## Thermal Resistance

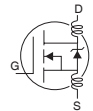
|                 | Parameter                           | Typ. | Max. | Units |
|-----------------|-------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case ④                  | —    | 1.88 | °C/W  |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.50 | —    |       |
| $R_{\theta JA}$ | Junction-to-Ambient ④               | —    | 62   |       |

Notes ① through ⑤ are on page 2

www.irf.com

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

|                                | Parameter                            | Min. | Typ. | Max. | Units                | Conditions                                                                                                 |
|--------------------------------|--------------------------------------|------|------|------|----------------------|------------------------------------------------------------------------------------------------------------|
| $BV_{DSS}$                     | Drain-to-Source Breakdown Voltage    | 150  | —    | —    | V                    | $V_{GS} = 0V, I_D = 250\mu A$                                                                              |
| $\Delta BV_{DSS}/\Delta T_J$   | Breakdown Voltage Temp. Coefficient  | —    | 0.19 | —    | V/ $^\circ\text{C}$  | Reference to $25^\circ\text{C}$ , $I_D = 1\text{mA}$                                                       |
| $R_{DS(on)}$                   | Static Drain-to-Source On-Resistance | —    | 80   | 95   | m $\Omega$           | $V_{GS} = 10V, I_D = 10A$ ③                                                                                |
| $V_{GS(th)}$                   | Gate Threshold Voltage               | 3.0  | —    | 4.9  | V                    | $V_{DS} = V_{GS}, I_D = 50\mu A$                                                                           |
| $\Delta V_{GS(th)}/\Delta T_J$ | Gate Threshold Voltage Coefficient   | —    | -13  | —    | mV/ $^\circ\text{C}$ |                                                                                                            |
| $I_{DSS}$                      | Drain-to-Source Leakage Current      | —    | —    | 20   | $\mu A$              | $V_{DS} = 150V, V_{GS} = 0V$                                                                               |
|                                |                                      | —    | —    | 250  |                      | $V_{DS} = 150V, V_{GS} = 0V, T_J = 125^\circ\text{C}$                                                      |
| $I_{GSS}$                      | Gate-to-Source Forward Leakage       | —    | —    | 100  | nA                   | $V_{GS} = 20V$                                                                                             |
|                                | Gate-to-Source Reverse Leakage       | —    | —    | -100 |                      | $V_{GS} = -20V$                                                                                            |
| $g_{fs}$                       | Forward Transconductance             | 14   | —    | —    | S                    | $V_{DS} = 10V, I_D = 10A$                                                                                  |
| $Q_g$                          | Total Gate Charge                    | —    | 13   | 20   | nC                   | $V_{DS} = 75V$<br>$V_{GS} = 10V$<br>$I_D = 10A$<br>See Fig. 6 and 19                                       |
| $Q_{gs1}$                      | Pre-Vth Gate-to-Source Charge        | —    | 3.3  | —    |                      |                                                                                                            |
| $Q_{gs2}$                      | Post-Vth Gate-to-Source Charge       | —    | 0.95 | —    |                      |                                                                                                            |
| $Q_{gd}$                       | Gate-to-Drain Charge                 | —    | 4.1  | —    |                      |                                                                                                            |
| $Q_{godr}$                     | Gate Charge Overdrive                | —    | 4.7  | —    |                      |                                                                                                            |
| $Q_{sw}$                       | Switch Charge ( $Q_{gs2} + Q_{gd}$ ) | —    | 5.1  | —    |                      |                                                                                                            |
| $R_{G(int)}$                   | Internal Gate Resistance             | —    | 2.4  | —    | $\Omega$             |                                                                                                            |
| $t_{d(on)}$                    | Turn-On Delay Time                   | —    | 7.0  | —    | ns                   | $V_{DD} = 75V, V_{GS} = 10V$ ③<br>$I_D = 10A$<br>$R_G = 2.4\Omega$                                         |
| $t_r$                          | Rise Time                            | —    | 13   | —    |                      |                                                                                                            |
| $t_{d(off)}$                   | Turn-Off Delay Time                  | —    | 12   | —    |                      |                                                                                                            |
| $t_f$                          | Fall Time                            | —    | 7.8  | —    |                      |                                                                                                            |
| $C_{iss}$                      | Input Capacitance                    | —    | 800  | —    | pF                   | $V_{GS} = 0V$<br>$V_{DS} = 50V$<br>$f = 1.0\text{MHz}$ , See Fig.5<br>$V_{GS} = 0V, V_{DS} = 0V$ to $120V$ |
| $C_{oss}$                      | Output Capacitance                   | —    | 74   | —    |                      |                                                                                                            |
| $C_{rss}$                      | Reverse Transfer Capacitance         | —    | 19   | —    |                      |                                                                                                            |
| $C_{oss}$                      | Effective Output Capacitance         | —    | 99   | —    |                      |                                                                                                            |
| $L_D$                          | Internal Drain Inductance            | —    | 4.5  | —    | nH                   | Between lead,<br>6mm (0.25in.)<br>from package<br>and center of die contact                                |
| $L_S$                          | Internal Source Inductance           | —    | 7.5  | —    |                      |                                                                                                            |



## Avalanche Characteristics

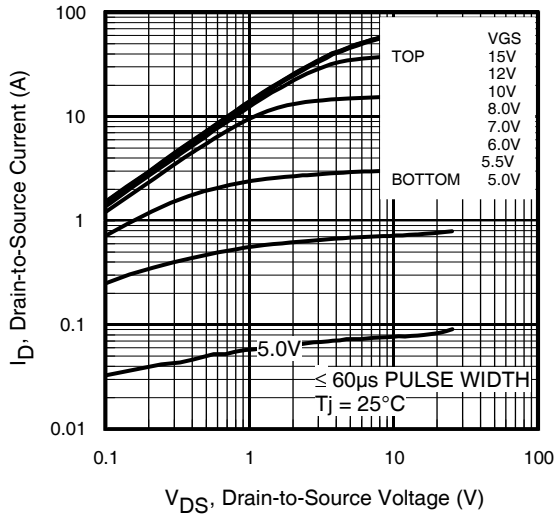
|          | Parameter                       | Typ.                      | Max. | Units |
|----------|---------------------------------|---------------------------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy ② | —                         | 73   | mJ    |
| $I_{AR}$ | Avalanche Current ⑤             | See Fig. 14, 15, 17a, 17b |      | A     |
| $E_{AR}$ | Repetitive Avalanche Energy ⑤   |                           |      | mJ    |

## Diode Characteristics

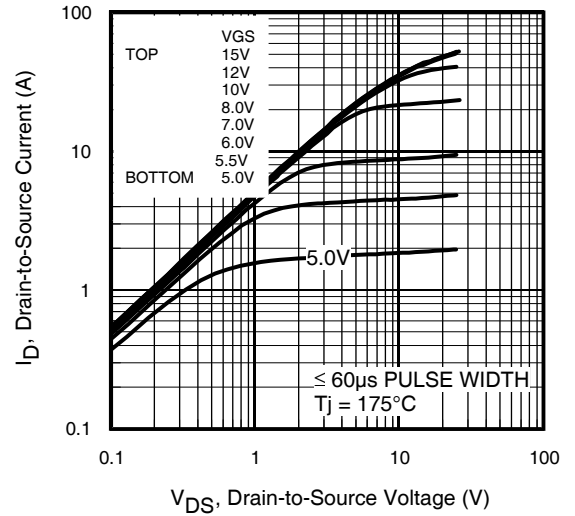
|                                | Parameter                                 | Min. | Typ. | Max. | Units | Conditions                                                              |
|--------------------------------|-------------------------------------------|------|------|------|-------|-------------------------------------------------------------------------|
| $I_S @ T_C = 25^\circ\text{C}$ | Continuous Source Current<br>(Body Diode) | —    | —    | 17   | A     | MOSFET symbol<br>showing the<br>integral reverse<br>p-n junction diode. |
| $I_{SM}$                       | Pulsed Source Current<br>(Body Diode) ①   | —    | —    | 51   |       |                                                                         |
| $V_{SD}$                       | Diode Forward Voltage                     | —    | —    | 1.3  | V     | $T_J = 25^\circ\text{C}, I_S = 10A, V_{GS} = 0V$ ③                      |
| $t_{rr}$                       | Reverse Recovery Time                     | —    | 64   | 96   | ns    | $T_J = 25^\circ\text{C}, I_F = 10A$                                     |
| $Q_{rr}$                       | Reverse Recovery Charge                   | —    | 160  | 240  | nC    | $di/dt = 100A/\mu s$ ③                                                  |

### Notes:

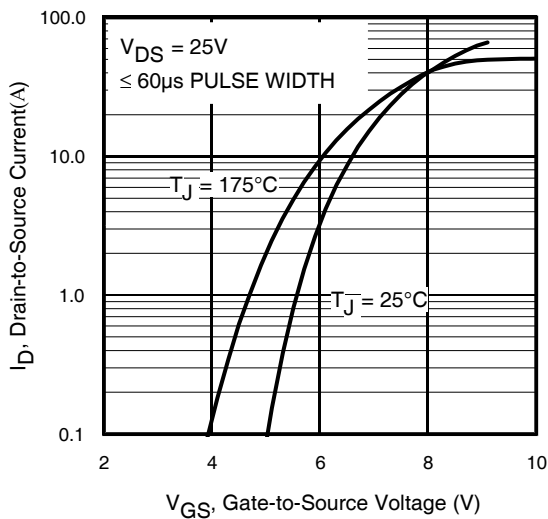
- ① Repetitive rating; pulse width limited by max. junction temperature. ④  $R_{\theta}$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .  
 ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 1.46\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 10A$ . ⑤ Limited by  $T_{jmax}$ . See Figs. 14, 15, 17a, 17b for repetitive avalanche information  
 ③ Pulse width  $\leq 400\mu s$ ; duty cycle  $\leq 2\%$ .



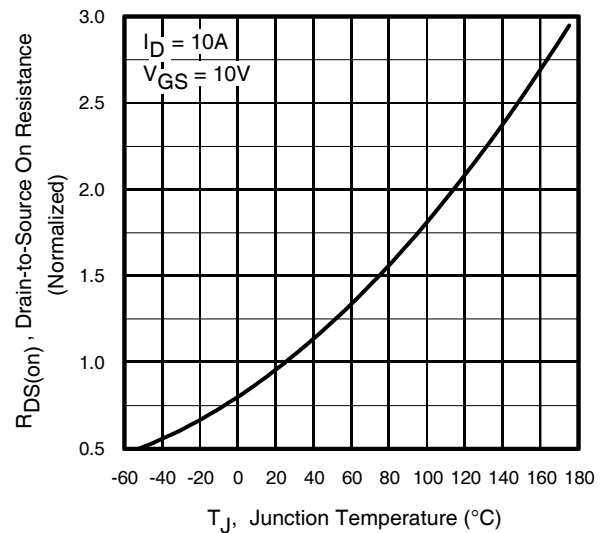
**Fig 1.** Typical Output Characteristics



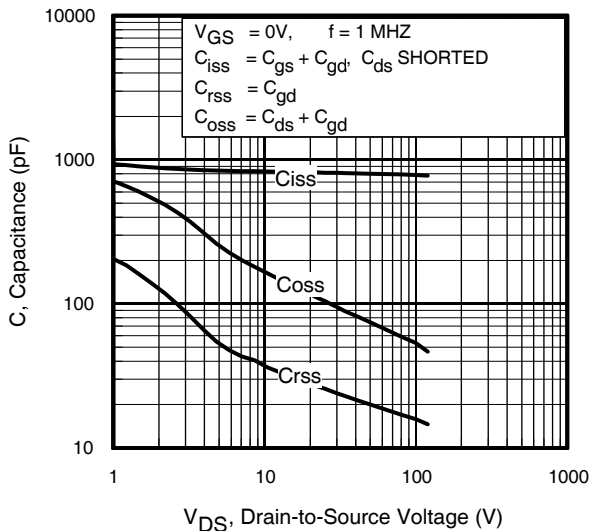
**Fig 2.** Typical Output Characteristics



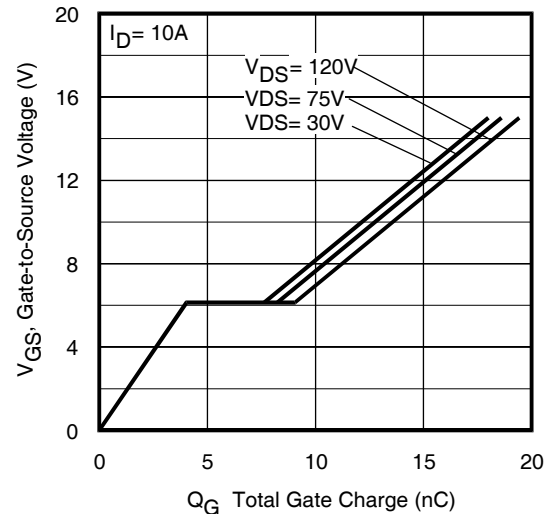
**Fig 3.** Typical Transfer Characteristics



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



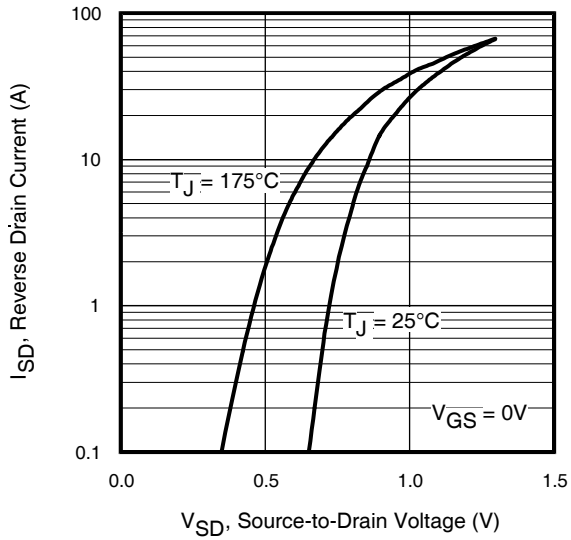
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage  
www.irf.com



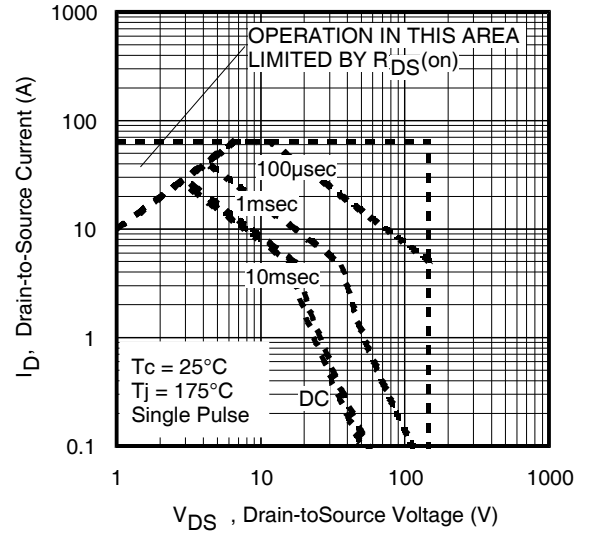
**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage

# IRFB4019PbF

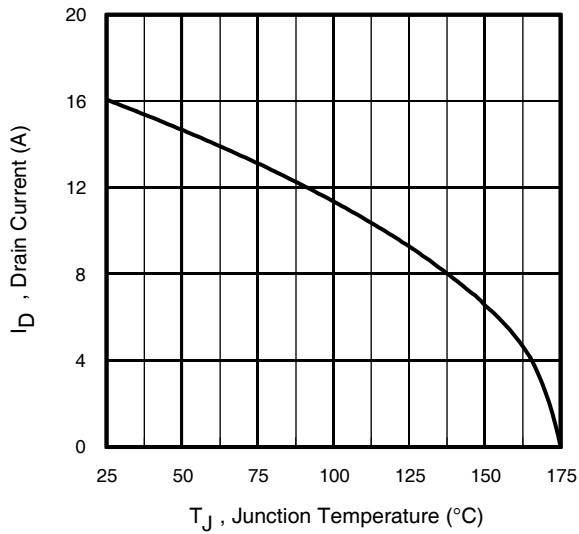
International  
**IR** Rectifier



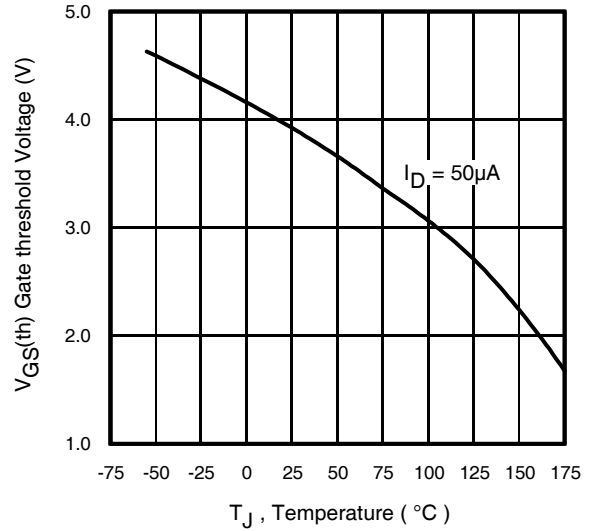
**Fig 7.** Typical Source-Drain Diode Forward Voltage



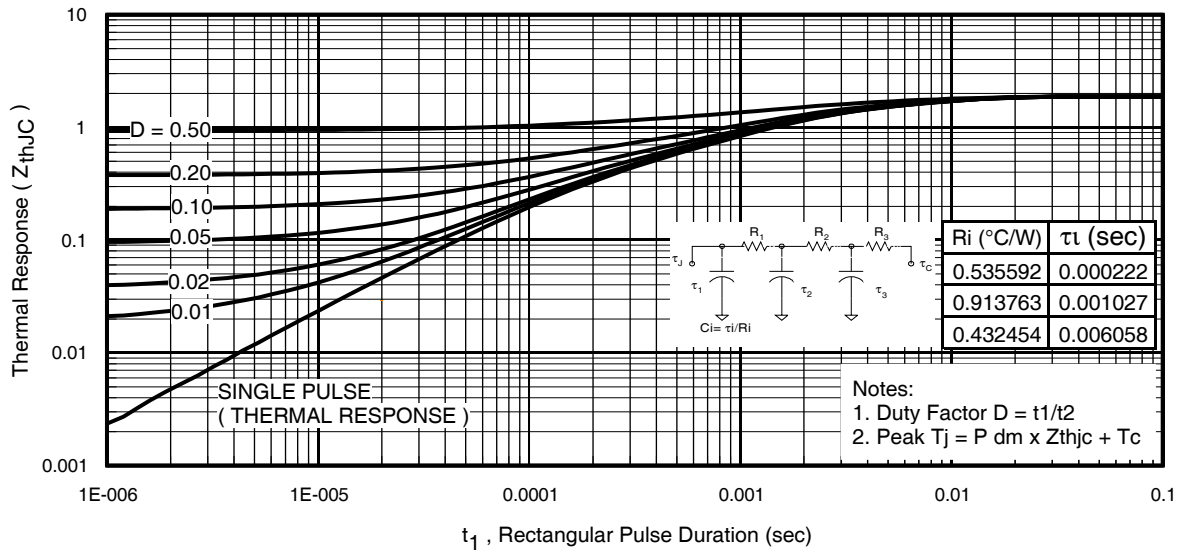
**Fig 8.** Maximum Safe Operating Area



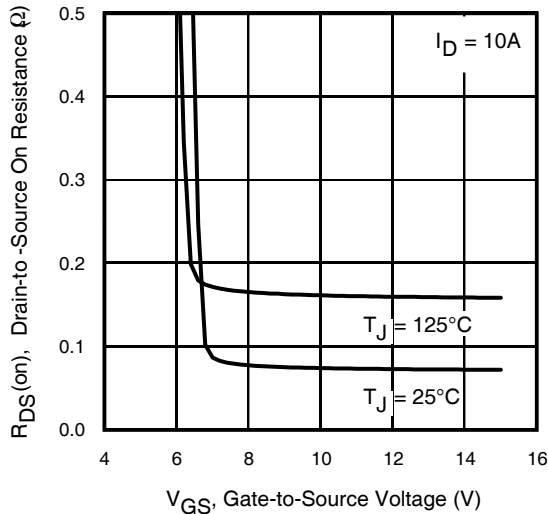
**Fig 9.** Maximum Drain Current vs. Case Temperature



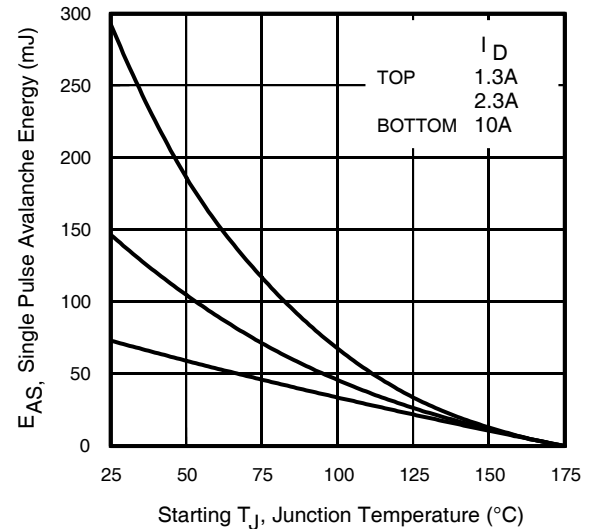
**Fig 10.** Threshold Voltage vs. Temperature



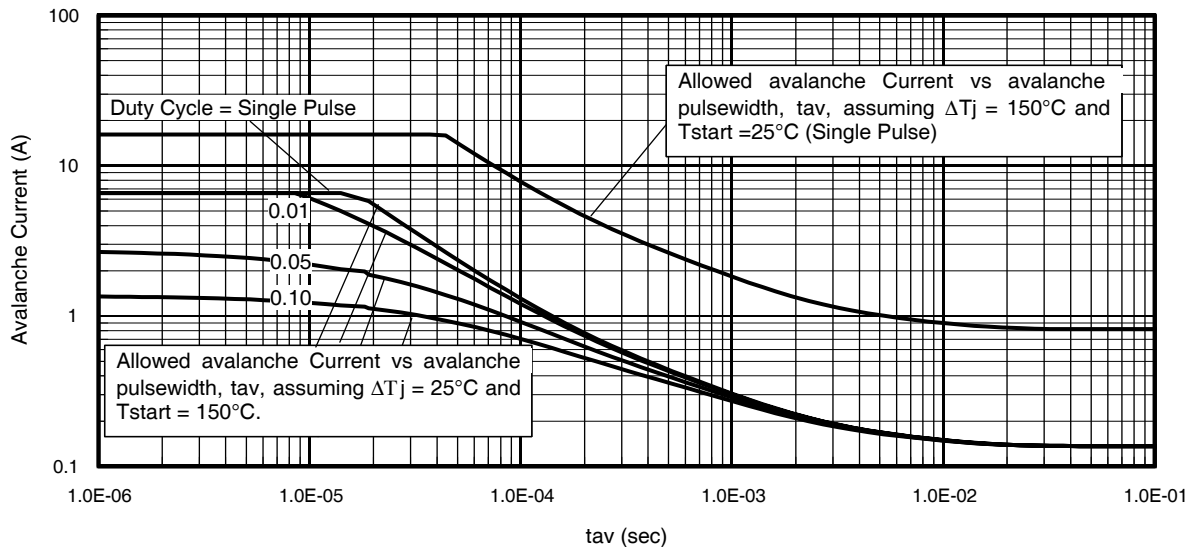
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



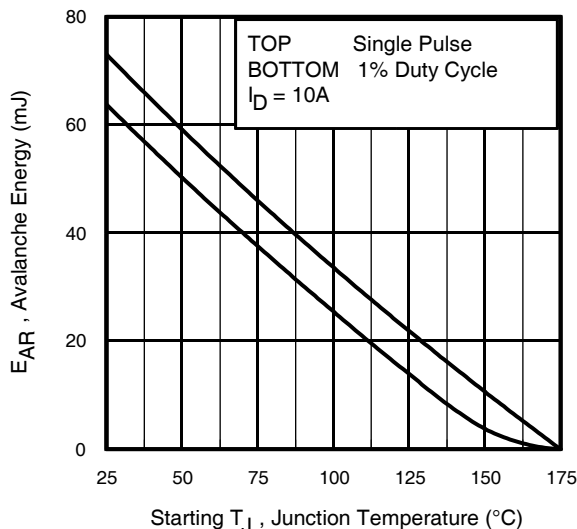
**Fig 12.** On-Resistance Vs. Gate Voltage



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



**Fig 14.** Typical Avalanche Current Vs. Pulsewidth



**Fig 15.** Maximum Avalanche Energy Vs. Temperature

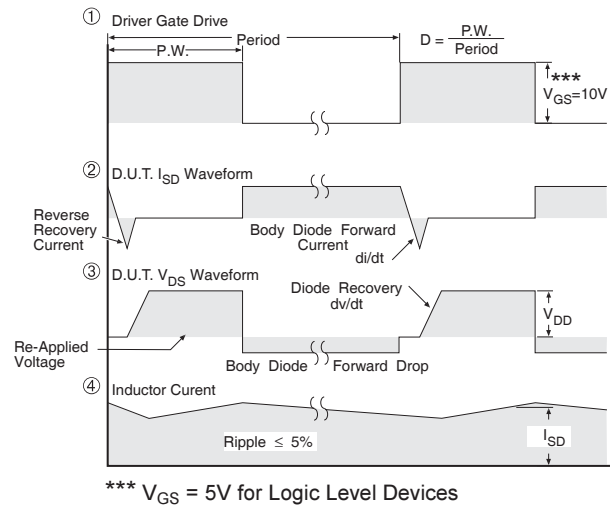
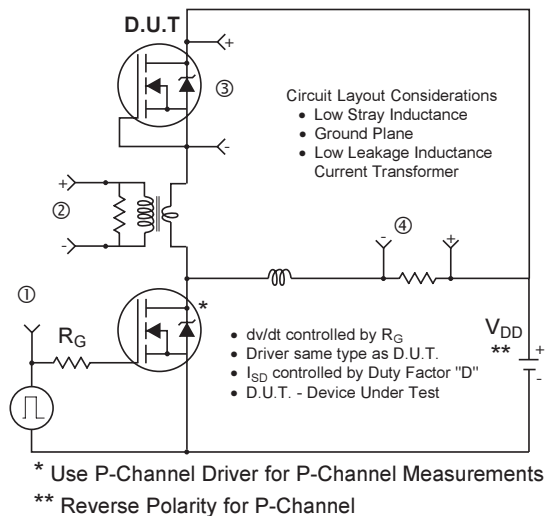
**Notes on Repetitive Avalanche Curves , Figures 14, 15:**  
(For further info, see AN-1005 at [www.irf.com](http://www.irf.com))

1. Avalanche failures assumption:  
Purely a thermal phenomenon and failure occurs at a temperature far in excess of  $T_{jmax}$ . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as neither  $T_{jmax}$  nor  $I_{av}$  (max) is exceeded
3. Equation below based on circuit and waveforms shown in Figures 17a, 17b.
4.  $P_{D(ave)}$  = Average power dissipation per single avalanche pulse.
5.  $B_V$  = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6.  $I_{av}$  = Allowable avalanche current.
7.  $\Delta T$  = Allowable rise in junction temperature, not to exceed  $T_{jmax}$  (assumed as 25°C in Figure 14, 15).  
 $t_{av}$  = Average time in avalanche.  
 $D$  = Duty cycle in avalanche =  $t_{av} \cdot f$   
 $Z_{thJC}(D, t_{av})$  = Transient thermal resistance, see figure 11)

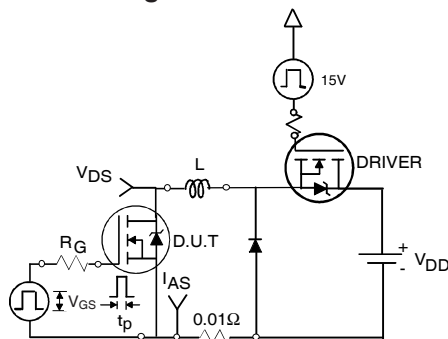
$$P_{D(ave)} = 1/2 (1.3 \cdot B_V \cdot I_{av}) = \Delta T / Z_{thJC}$$

$$I_{av} = 2\Delta T / [1.3 \cdot B_V \cdot Z_{th}]$$

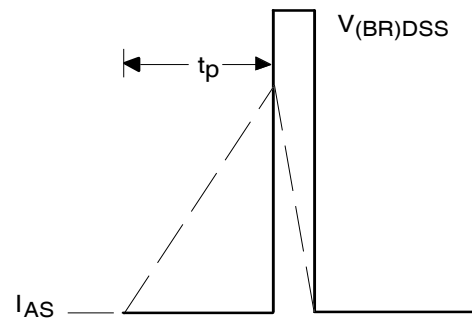
$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$



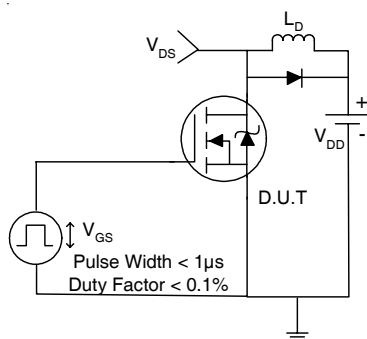
**Fig 16. Diode Reverse Recovery Test Circuit for HEXFET® Power MOSFETs**



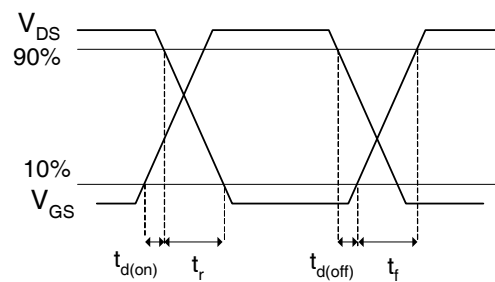
**Fig 17a. Unclamped Inductive Test Circuit**



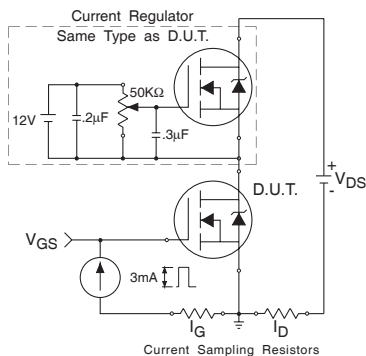
**Fig 17b. Unclamped Inductive Waveforms**



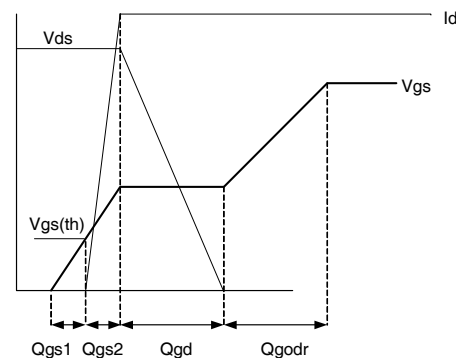
**Fig 18a. Switching Time Test Circuit**



**Fig 18b. Switching Time Waveforms**

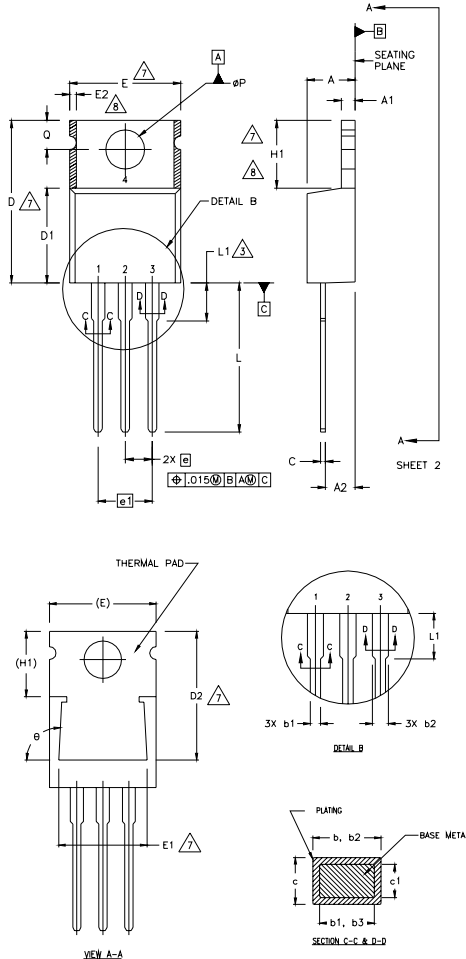


**Fig 19a. Gate Charge Test Circuit**



**Fig 19b. Gate Charge Waveform**

## TO-220AB Package Outline (Dimensions are shown in millimeters (inches))



### NOTES:

- 1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
- 2 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
- 3 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- 4 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- 5 DIMENSION b1 & c1 APPLY TO BASE METAL ONLY. CONTROLLING DIMENSION : INCHES.
- 6
- 7 THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
- 8 DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.

### LEAD ASSIGNMENTS

#### HEXFET

- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE

#### IGBTs, CoPACK

- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER

#### DIODES

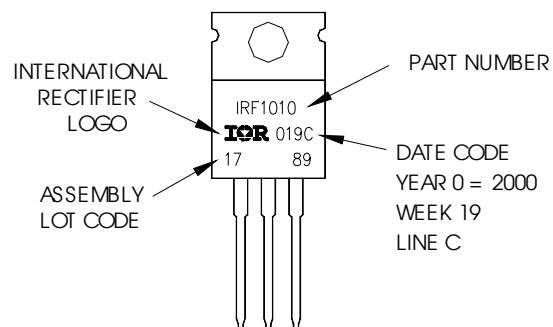
- 1.- ANODE/OPEN
- 2.- CATHODE
- 3.- ANODE

| SYMBOL | DIMENSIONS  |       |          |      | NOTES |
|--------|-------------|-------|----------|------|-------|
|        | MILLIMETERS |       | INCHES   |      |       |
|        | MIN.        | MAX.  | MIN.     | MAX. |       |
| A      | 3.56        | 4.82  | .140     | .190 | 5     |
| A1     | 0.51        | 1.40  | .020     | .055 |       |
| A2     | 2.04        | 2.92  | .080     | .115 |       |
| b      | 0.38        | 1.01  | .015     | .040 |       |
| b1     | 0.38        | 0.96  | .015     | .038 |       |
| b2     | 1.15        | 1.77  | .045     | .070 | 4     |
| b3     | 1.15        | 1.73  | .045     | .068 |       |
| c      | 0.36        | 0.61  | .014     | .024 |       |
| c1     | 0.36        | 0.56  | .014     | .022 | 5     |
| D      | 14.22       | 16.51 | .560     | .650 | 7     |
| D1     | 8.38        | 9.02  | .330     | .355 |       |
| D2     | 12.19       | 12.88 | .480     | .507 | 4,7   |
| E      | 9.66        | 10.66 | .380     | .420 |       |
| E1     | 8.38        | 8.89  | .330     | .350 | 7     |
| e      | 2.54 BSC    |       | .100 BSC |      | 7,8   |
| e1     | 5.08        |       | .200 BSC |      |       |
| H1     | 5.85        | 6.55  | .230     | .270 | 3     |
| L      | 12.70       | 14.73 | .500     | .580 |       |
| L1     | -           | 6.35  | -        | .250 | 3     |
| ØP     | 3.54        | 4.08  | .139     | .161 |       |
| Q      | 2.54        | 3.42  | .100     | .135 | 3     |
| Ø      | 90°-93°     |       | 90°-93°  |      |       |

## TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010  
LOT CODE 1789  
ASSEMBLED ON WW 19, 2000  
IN THE ASSEMBLY LINE "C"

Note: "P" in assembly line position  
indicates "Lead - Free"



TO-220AB packages are not recommended for Surface Mount Application.

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

International  
**IR** Rectifier

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

Visit us at [www.irf.com](http://www.irf.com) for sales contact information. 03/06

Note: For the most current drawings please refer to the IR website at:  
<http://www.irf.com/package/>



## IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenhheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office ([www.infineon.com](http://www.infineon.com)).

## WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Infineon:](#)

[IRFB4019PBF](#)