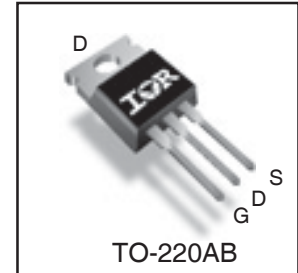
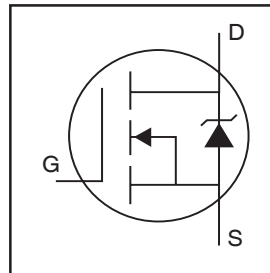


# IRFB4229PbF

## Features

- Advanced Process Technology
- Key Parameters Optimized for PDP Sustain, Energy Recovery and Pass Switch Applications
- Low  $E_{PULSE}$  Rating to Reduce Power Dissipation in PDP Sustain, Energy Recovery and Pass Switch Applications
- Low  $Q_G$  for Fast Response
- High Repetitive Peak Current Capability for Reliable Operation
- Short Fall & Rise Times for Fast Switching
- 175°C Operating Junction Temperature for Improved Ruggedness
- Repetitive Avalanche Capability for Robustness and Reliability
- Class-D Audio Amplifier 300W-500W (Half-bridge)

Key Parameters		
$V_{DS\ min}$	250	V
$V_{DS\ (Avalanche)\ typ.}$	300	V
$R_{DS(ON)\ typ.\ @\ 10V}$	38	m $\Omega$
$I_{RP\ max\ @\ T_C = 100^\circ C}$	91	A
$T_J\ max$	175	°C



G	D	S
Gate	Drain	Source

## Description

This HEXFET® Power MOSFET is specifically designed for Sustain; Energy Recovery & Pass switch applications in Plasma Display Panels. This MOSFET utilizes the latest processing techniques to achieve low on-resistance per silicon area and low  $E_{PULSE}$  rating. Additional features of this MOSFET are 175°C operating junction temperature and high repetitive peak current capability. These features combine to make this MOSFET a highly efficient, robust and reliable device for PDP driving applications.

## Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{GS}$	Gate-to-Source Voltage	±30	V
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	46	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	33	
$I_{DM}$	Pulsed Drain Current ①	180	
$I_{RP} @ T_C = 100^\circ C$	Repetitive Peak Current ②	91	
$P_D @ T_C = 25^\circ C$	Power Dissipation	330	W
$P_D @ T_C = 100^\circ C$	Power Dissipation	190	
	Linear Derating Factor	2.2	W/°C
$T_J$	Operating Junction and	-40 to + 175	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature for 10 seconds	300	
	Mounting Torque, 6-32 or M3 Screw	10lb·in (1.1N·m)	N

## Thermal Resistance

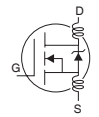
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ④	—	0.45	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient ④	—	62	

Notes ① through ⑤ are on page 8

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	250	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	210	—	mV/°C	Reference to $25^\circ\text{C}, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	38	46	mΩ	$V_{GS} = 10V, I_D = 26A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-14	—	mV/°C	
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 250V, V_{GS} = 0V$
		—	—	1.0	mA	$V_{DS} = 250V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100	nA	$V_{GS} = -20V$
$g_{fs}$	Forward Transconductance	83	—	—	S	$V_{DS} = 25V, I_D = 26A$
$Q_g$	Total Gate Charge	—	72	110	nC	$V_{DD} = 125V, I_D = 26A, V_{GS} = 10V$ ③
$Q_{gd}$	Gate-to-Drain Charge	—	26	—	nC	
$t_{d(on)}$	Turn-On Delay Time	—	18	—	ns	$V_{DD} = 125V, V_{GS} = 10V$ ③ $I_D = 26A$ $R_G = 2.4\Omega$ See Fig. 22
$t_r$	Rise Time	—	31	—		
$t_{d(off)}$	Turn-Off Delay Time	—	30	—		
$t_f$	Fall Time	—	21	—		
$t_{st}$	Shoot Through Blocking Time	100	—	—	ns	$V_{DD} = 200V, V_{GS} = 15V, R_G = 4.7\Omega$
$E_{PULSE}$	Energy per Pulse	—	790	—	μJ	$L = 220nH, C = 0.3\mu F, V_{GS} = 15V$ $V_{DS} = 200V, R_G = 4.7\Omega, T_J = 25^\circ\text{C}$
		—	1390	—		$L = 220nH, C = 0.3\mu F, V_{GS} = 15V$ $V_{DS} = 200V, R_G = 4.7\Omega, T_J = 100^\circ\text{C}$
$C_{iss}$	Input Capacitance	—	4560	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	390	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	100	—		$f = 1.0MHz,$
$C_{oss\ eff.}$	Effective Output Capacitance	—	290	—		$V_{GS} = 0V, V_{DS} = 0V\ to\ 200V$
$L_D$	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
$L_S$	Internal Source Inductance	—	7.5	—		

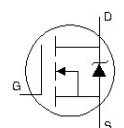


## Avalanche Characteristics

	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ②	—	130	mJ
$E_{AR}$	Repetitive Avalanche Energy ①	—	33	mJ
$V_{DS(Avalanche)}$	Repetitive Avalanche Voltage ①	300	—	V
$I_{AS}$	Avalanche Current ②	—	26	A

## Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S @ T_C = 25^\circ\text{C}$	Continuous Source Current (Body Diode)	—	—	46	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	180		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 26A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	190	290	ns	$T_J = 25^\circ\text{C}, I_F = 26A, V_{DD} = 50V$
$Q_{rr}$	Reverse Recovery Charge	—	840	1260	nC	$di/dt = 100A/\mu s$ ③



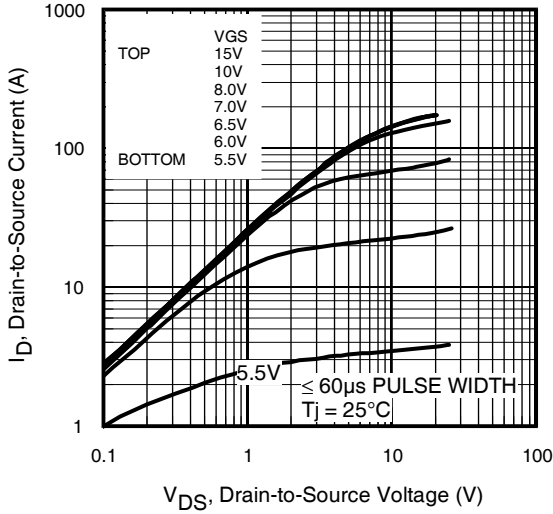


Fig 1. Typical Output Characteristics

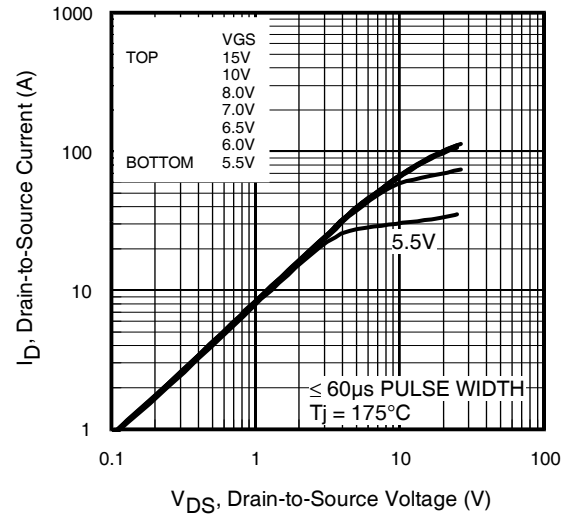


Fig 2. Typical Output Characteristics

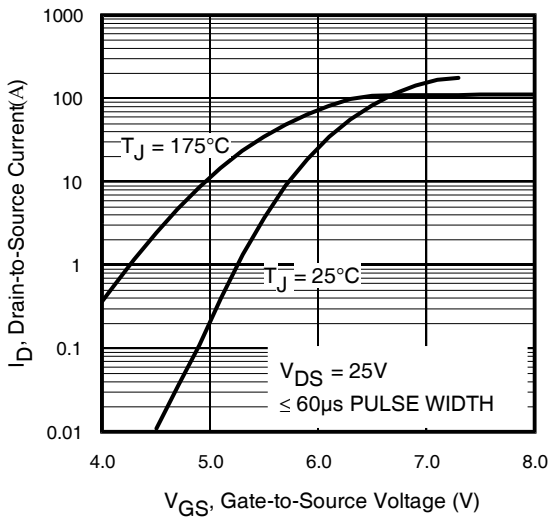


Fig 3. Typical Transfer Characteristics

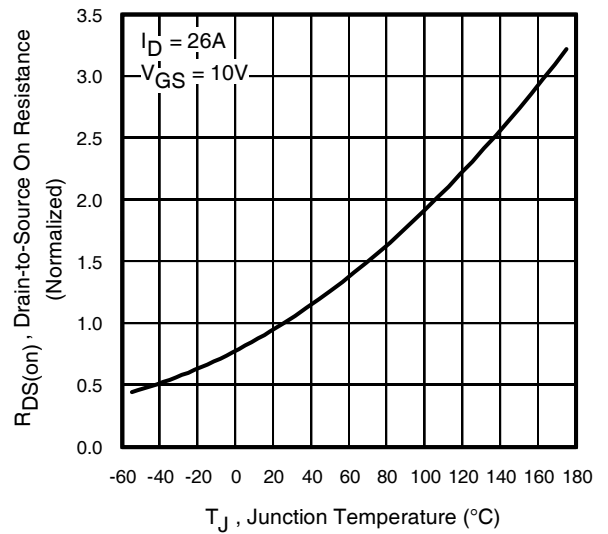


Fig 4. Normalized On-Resistance vs. Temperature

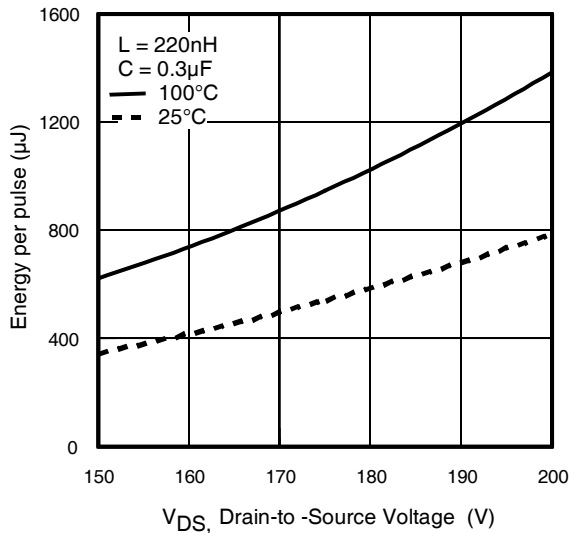


Fig 5. Typical  $E_{PULSE}$  vs. Drain-to-Source Voltage

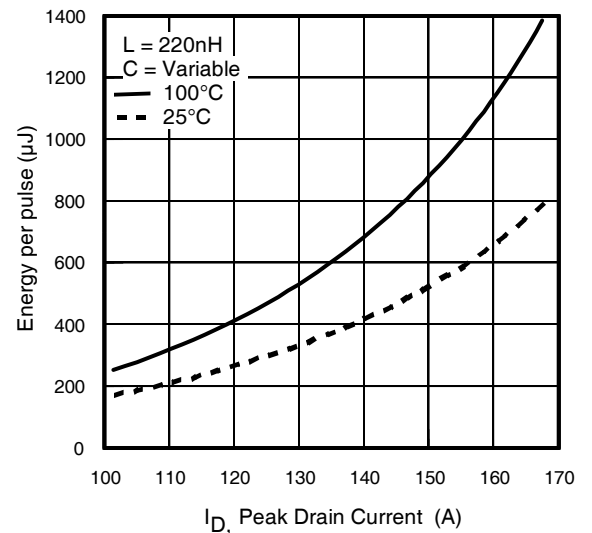
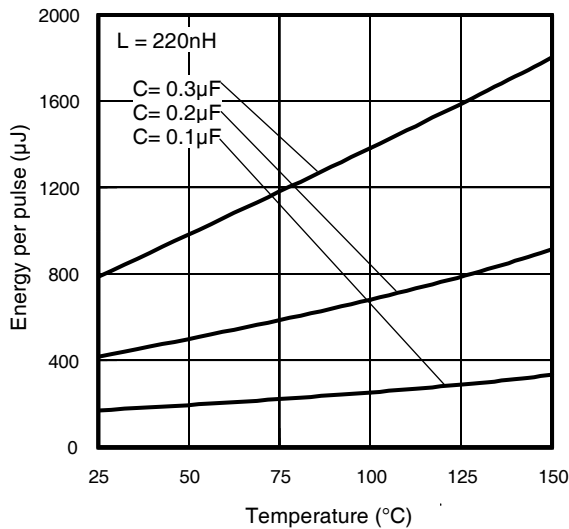
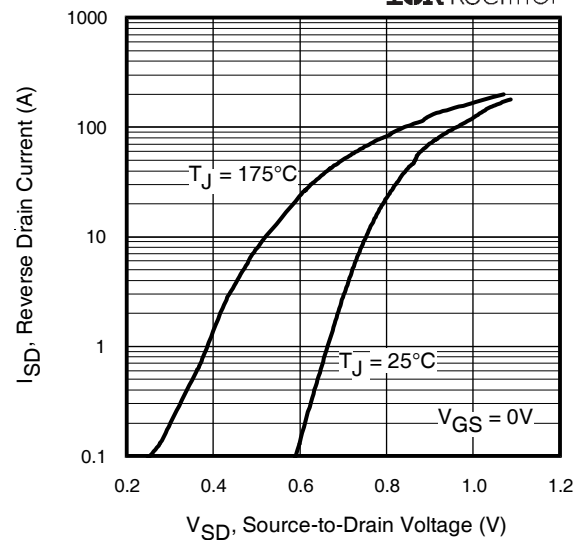


Fig 6. Typical  $E_{PULSE}$  vs. Drain Current

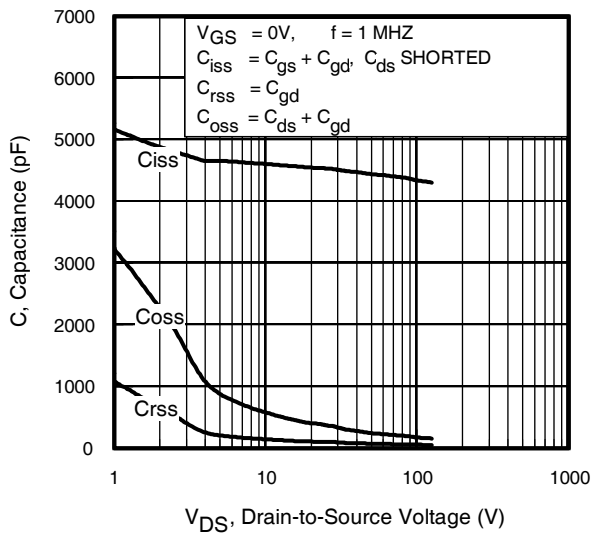
# IRFB4229PbF



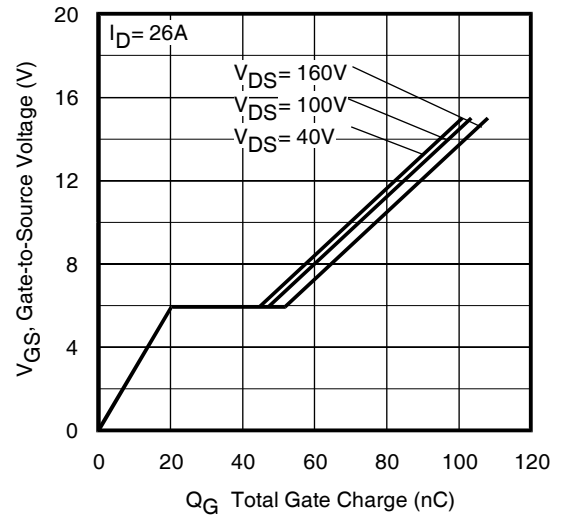
**Fig 7.** Typical  $E_{PULSE}$  vs. Temperature



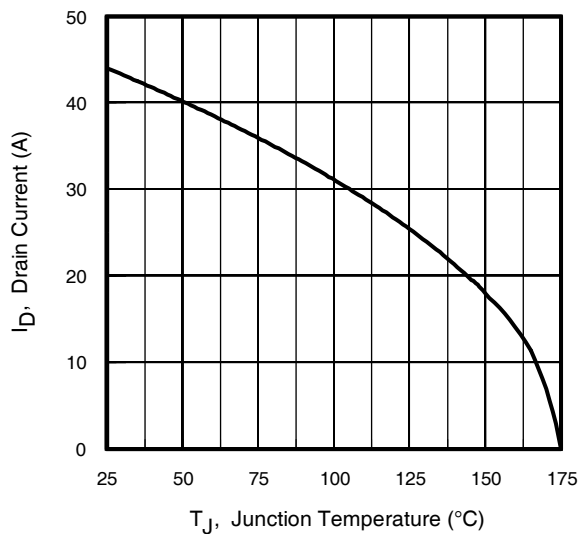
**Fig 8.** Typical Source-Drain Diode Forward Voltage



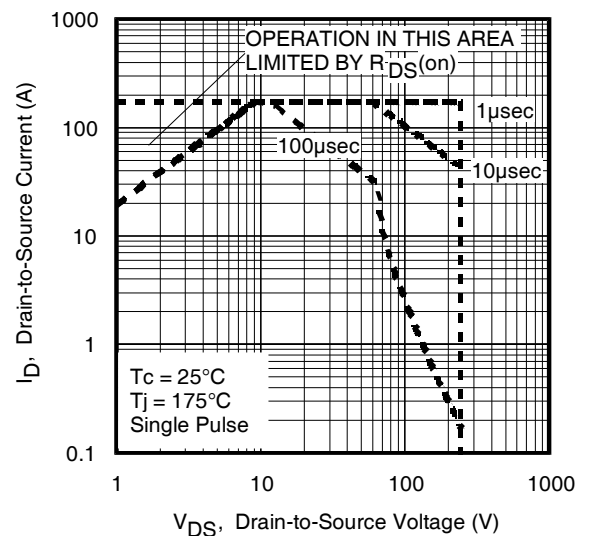
**Fig 9.** Typical Capacitance vs. Drain-to-Source Voltage



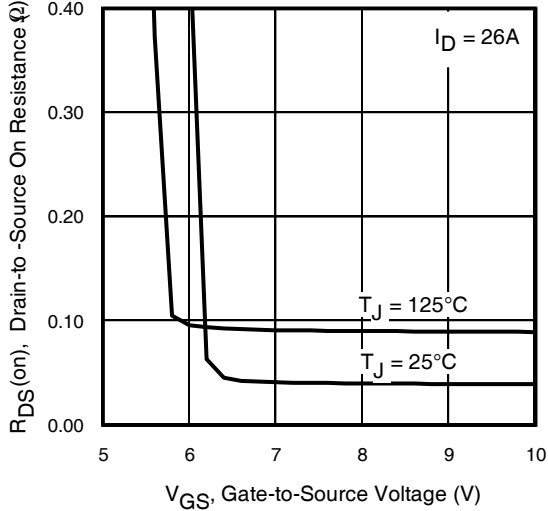
**Fig 10.** Typical Gate Charge vs. Gate-to-Source Voltage



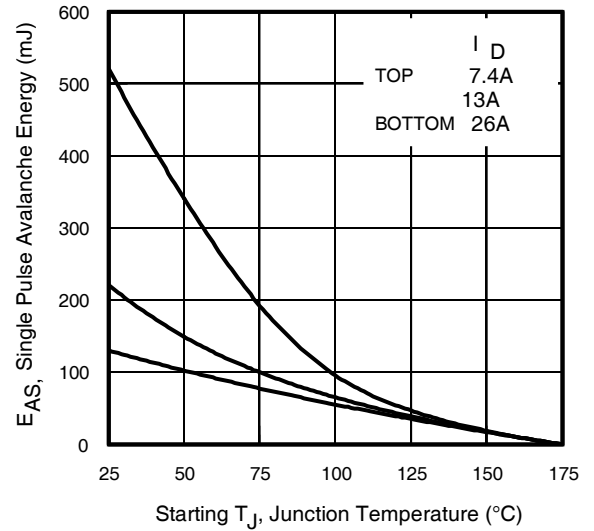
**Fig 11.** Maximum Drain Current vs. Case Temperature



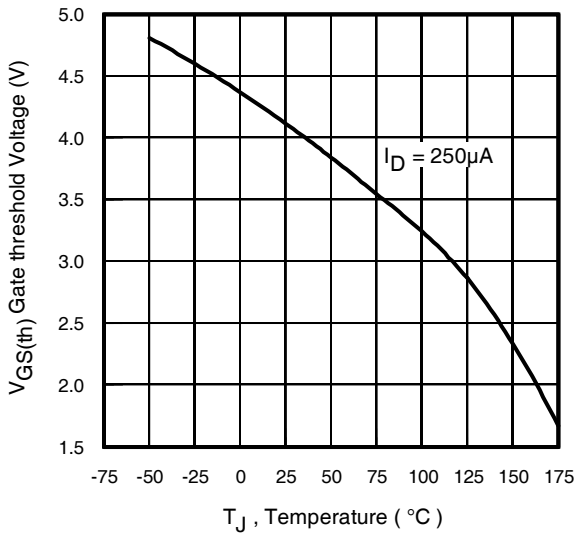
**Fig 12.** Maximum Safe Operating Area



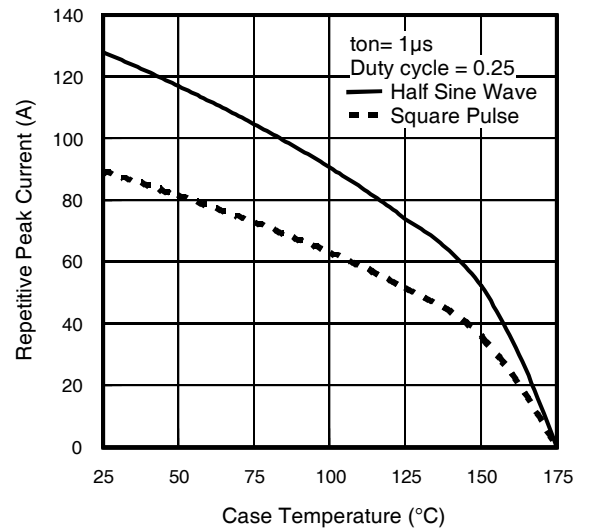
**Fig 13.** On-Resistance Vs. Gate Voltage



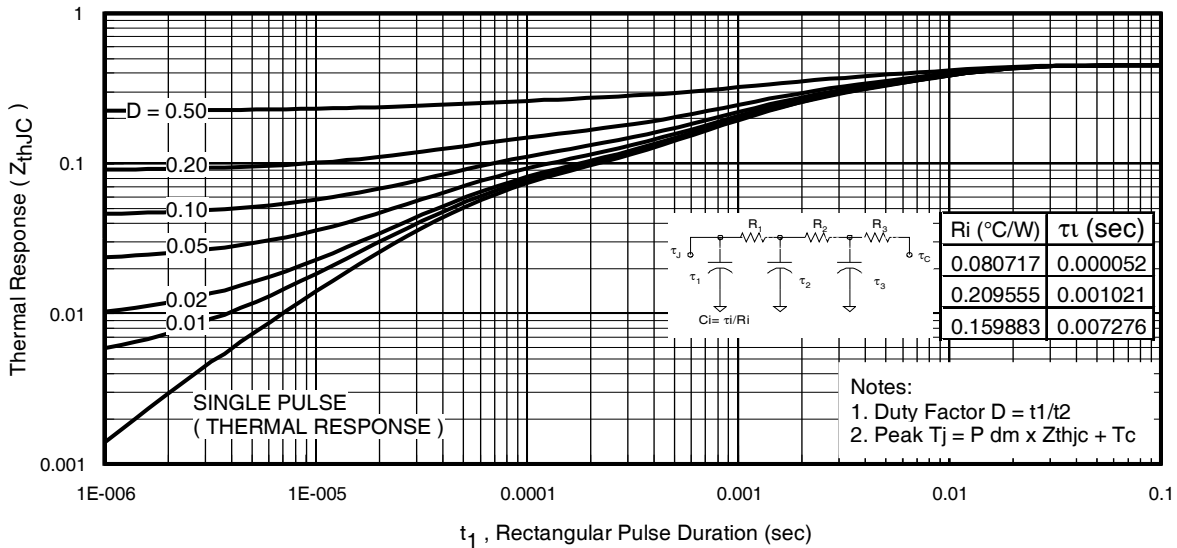
**Fig 14.** Maximum Avalanche Energy Vs. Temperature



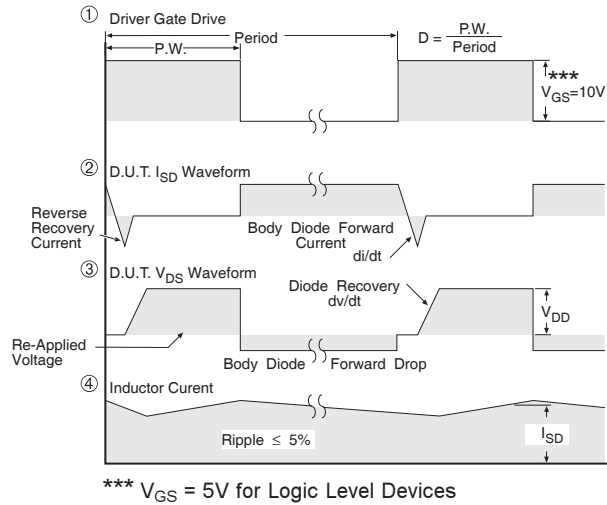
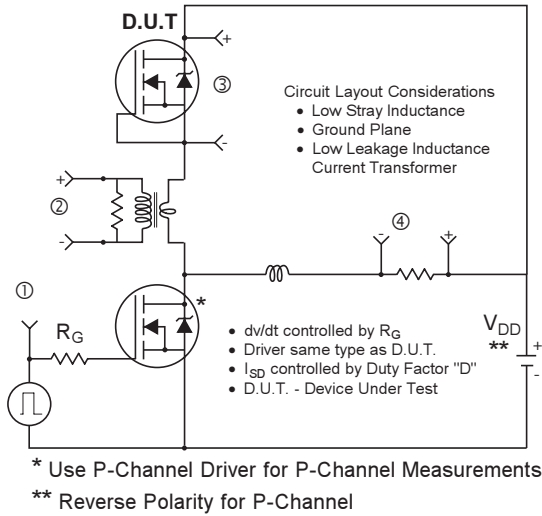
**Fig 15.** Threshold Voltage vs. Temperature



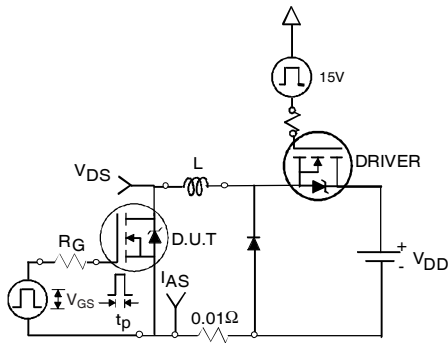
**Fig 16.** Typical Repetitive peak Current vs. Case temperature



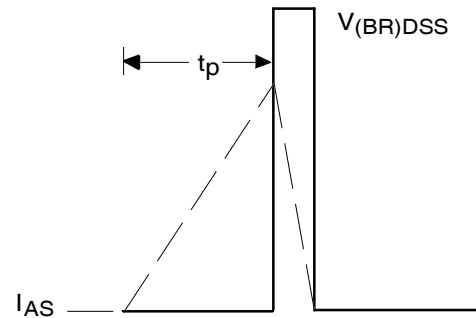
**Fig 17.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



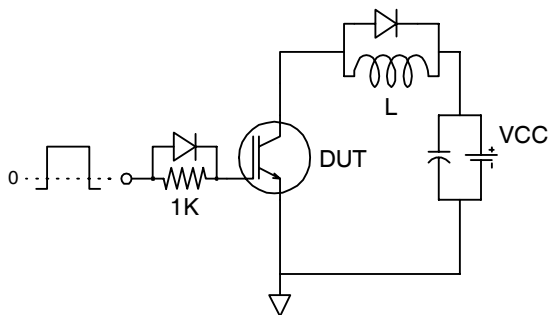
**Fig 18.** Diode Reverse Recovery Test Circuit for HEXFET® Power MOSFETs



**Fig 19a.** Unclamped Inductive Test Circuit



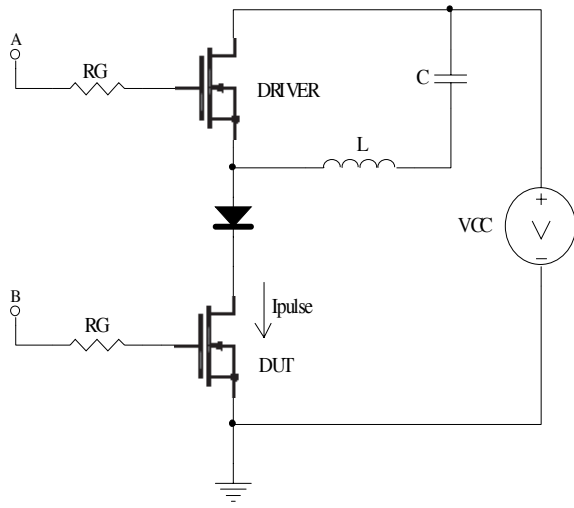
**Fig 19b.** Unclamped Inductive Waveforms



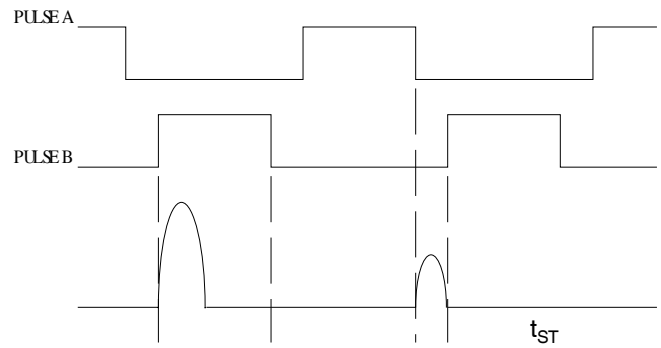
**Fig 20a.** Gate Charge Test Circuit



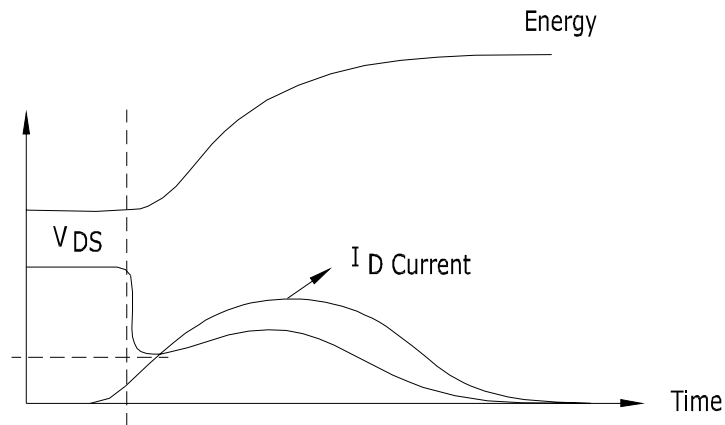
**Fig 20b.** Gate Charge Waveform



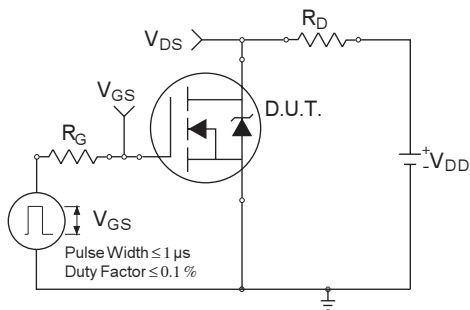
**Fig 21a.**  $t_{st}$  and  $E_{PULSE}$  Test Circuit



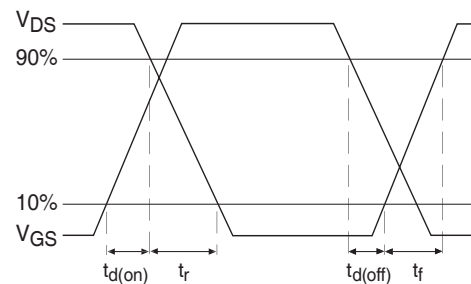
**Fig 21b.**  $t_{st}$  Test Waveforms



**Fig 21c.**  $E_{PULSE}$  Test Waveforms

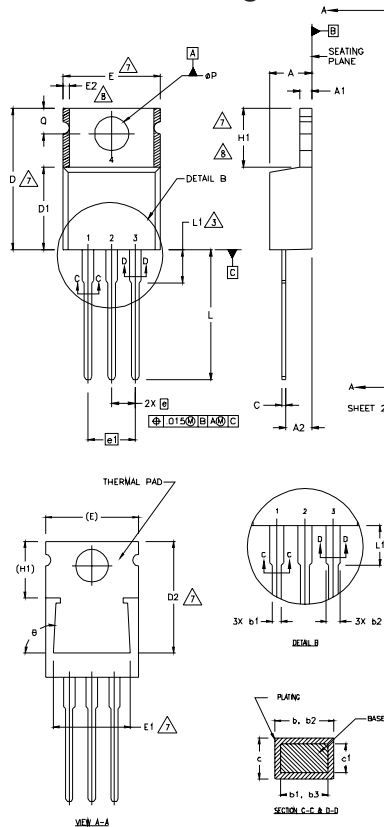


**Fig 22a.** Switching Time Test Circuit



**Fig 22b.** Switching Time Waveforms

## 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.
  - 6 CONTROLLING DIMENSION : INCHES.
  - 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

HEXFEET

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

IGBTs, GaPMOS

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

DIODES

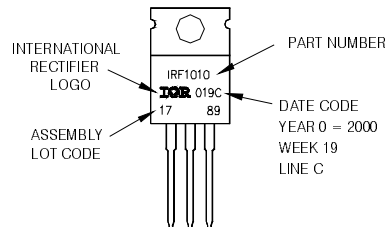
- 1.- ANODE/OPEN
- 2.- CATHODE
- 3.- ANODE

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.82	.140	.190	
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	5
b2	1.15	1.77	.045	.070	
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	4
D1	8.38	9.02	.330	.355	
D2	12.19	12.88	.480	.507	7
E	9.66	10.66	.380	.420	4,7
E1	8.38	8.89	.330	.350	7
e	2.54 BSC		.100 BSC		
e1	5.08		.200 BSC		
H1	5.85	6.55	.230	.270	7,8
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	
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.

**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.37\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 26\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④  $R_\theta$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .
- ⑤ Half sine wave with duty cycle = 0.25,  $t_{on}=1\mu\text{sec}$ .

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

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.