

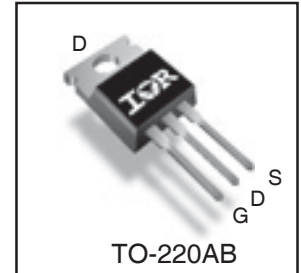
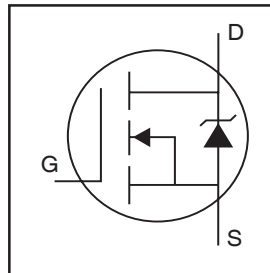
**PDP SWITCH**

**IRFB4332PbF**

**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

Key Parameters		
$V_{DS\ min}$	250	V
$V_{DS\ (Avalanche)\ typ.}$	300	V
$R_{DS(ON)\ typ.\ @\ 10V}$	29	mΩ
$T_J\ max$	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, $V_{GS} @ 10V$	60	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	42	
$I_{DM}$	Pulsed Drain Current ①	230	
$I_{RP} @ T_C = 100^\circ C$	Repetitive Peak Current ⑤⑥	120	
$P_D @ T_C = 25^\circ C$	Power Dissipation	390	W
$P_D @ T_C = 100^\circ C$	Power Dissipation	200	
	Linear Derating Factor	2.6	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

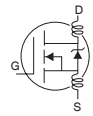
**Thermal Resistance**

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ④	—	0.38	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient ④	—	62	

Notes ① through ⑥ are on page 8

## 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	—	170	—	mV/°C	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	29	33	mΩ	$V_{GS} = 10V, I_D = 35A$ 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	100	—	—	S	$V_{DS} = 25V, I_D = 35A$
$Q_g$	Total Gate Charge	—	99	150	nC	$V_{DD} = 125V, I_D = 35A, V_{GS} = 10V$ ③
$Q_{gd}$	Gate-to-Drain Charge	—	35	—	nC	
$t_{st}$	Shoot Through Blocking Time	100	—	—	ns	$V_{DD} = 200V, V_{GS} = 15V, R_G = 4.7\Omega$
$E_{PULSE}$	Energy per Pulse	—	520	—	μJ	$L = 220\text{nH}, C = 0.3\mu F, V_{GS} = 15V$ $V_{DS} = 200V, R_G = 5.1\Omega, T_J = 25^\circ\text{C}$
		—	920	—	μJ	$L = 220\text{nH}, C = 0.3\mu F, V_{GS} = 15V$ $V_{DS} = 200V, R_G = 5.1\Omega, T_J = 100^\circ\text{C}$
$C_{iss}$	Input Capacitance	—	5860	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	530	—		$V_{DS} = 25V$
$C_{riss}$	Reverse Transfer Capacitance	—	130	—		$f = 1.0\text{MHz},$
$C_{oss\ eff.}$	Effective Output Capacitance	—	360	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 200V$
$L_D$	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	—		

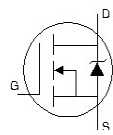


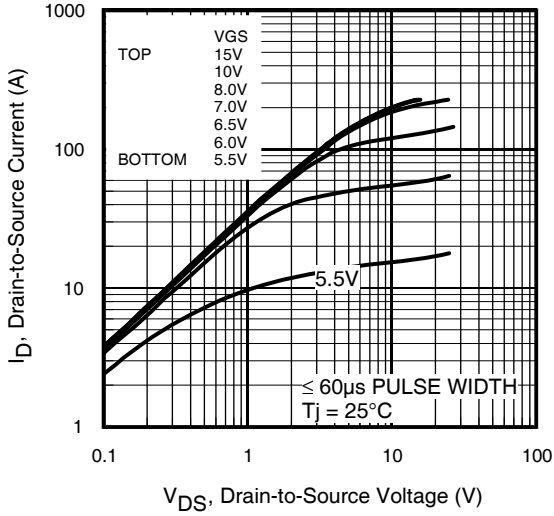
## Avalanche Characteristics

	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ②	—	230	mJ
$E_{AR}$	Repetitive Avalanche Energy ①	—	39	mJ
$V_{DS(Avalanche)}$	Repetitive Avalanche Voltage ①	300	—	V
$I_{AS}$	Avalanche Current ②	—	35	A

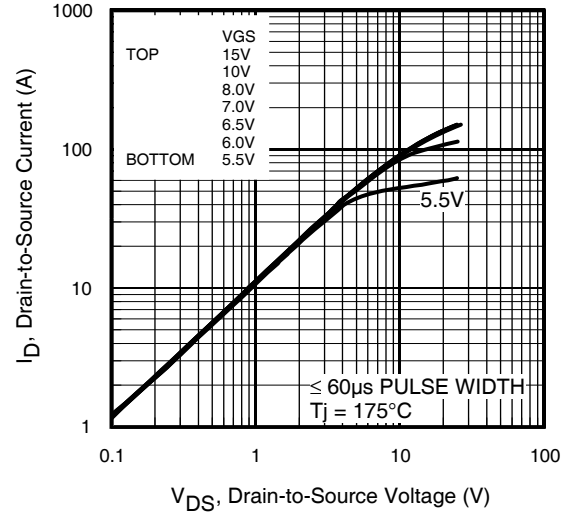
## Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S @ T_C = 25^\circ\text{C}$	Continuous Source Current (Body Diode)	—	—	60	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	230		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 35A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	190	290	ns	$T_J = 25^\circ\text{C}, I_F = 35A, V_{DD} = 50V$
$Q_{rr}$	Reverse Recovery Charge	—	820	1230	nC	$di/dt = 100A/\mu s$ ③

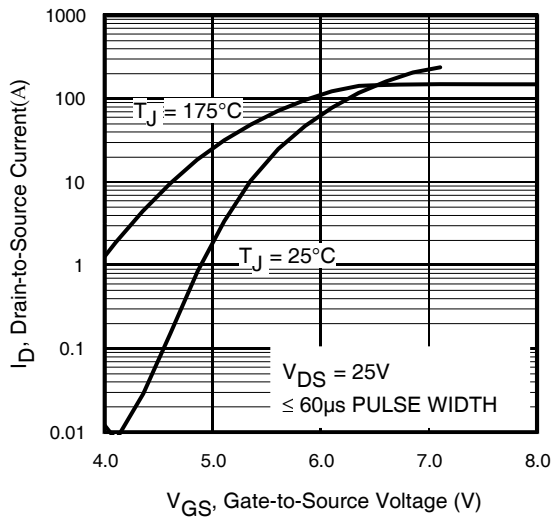




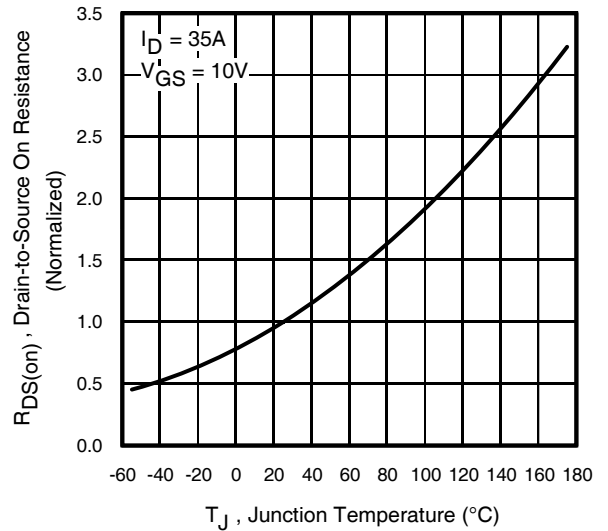
**Fig 1.** Typical Output Characteristics



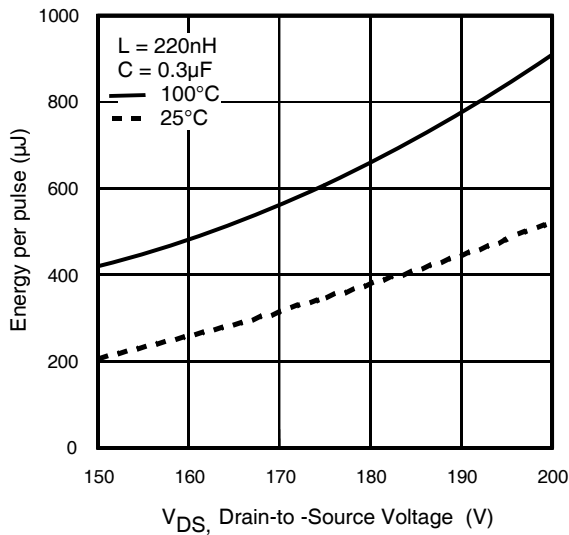
**Fig 2.** Typical Output Characteristics



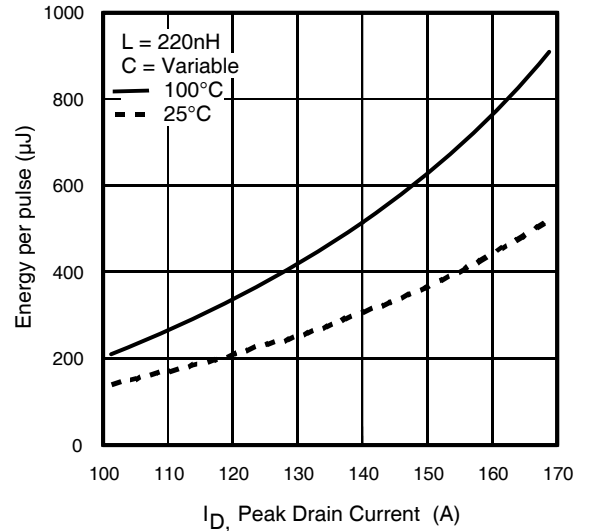
**Fig 3.** Typical Transfer Characteristics



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

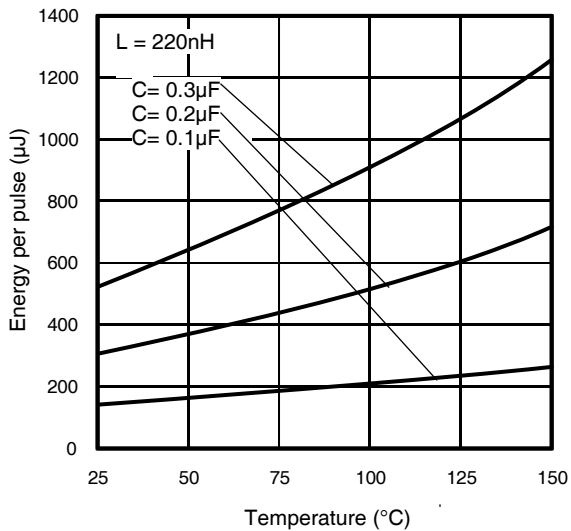


**Fig 5.** Typical  $E_{PULSE}$  vs. Drain-to-Source Voltage

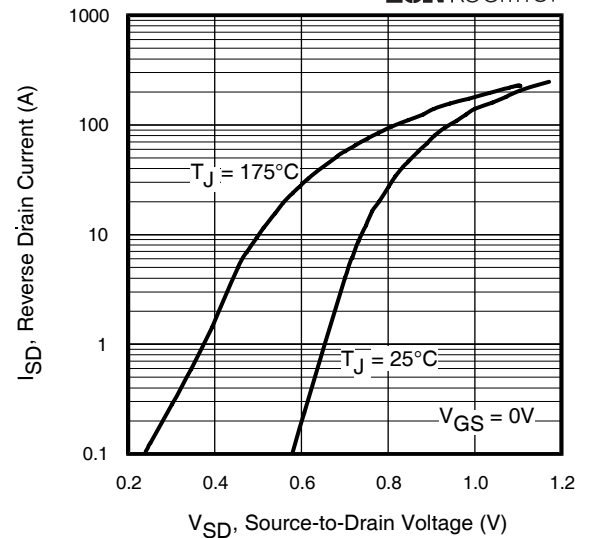


**Fig 6.** Typical  $E_{PULSE}$  vs. Drain Current

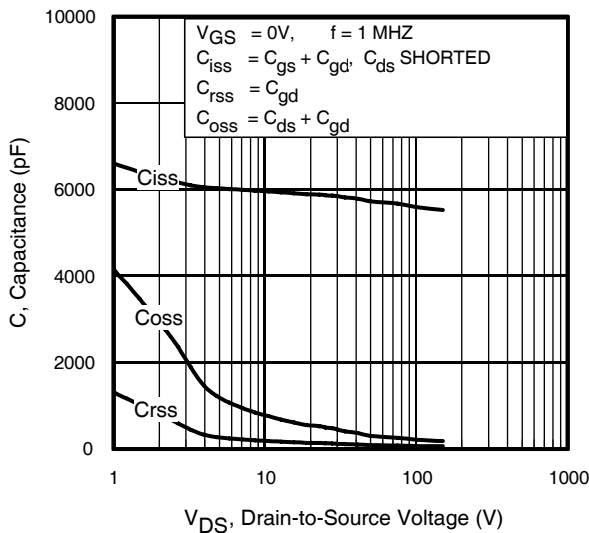
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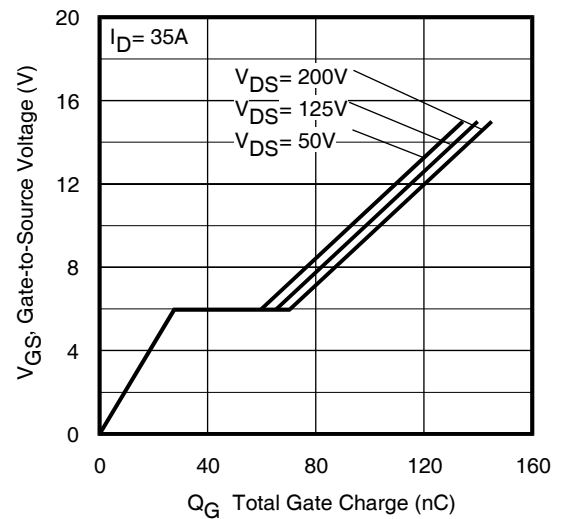
**Fig 7.** Typical  $E_{PULSE}$  vs. Temperature



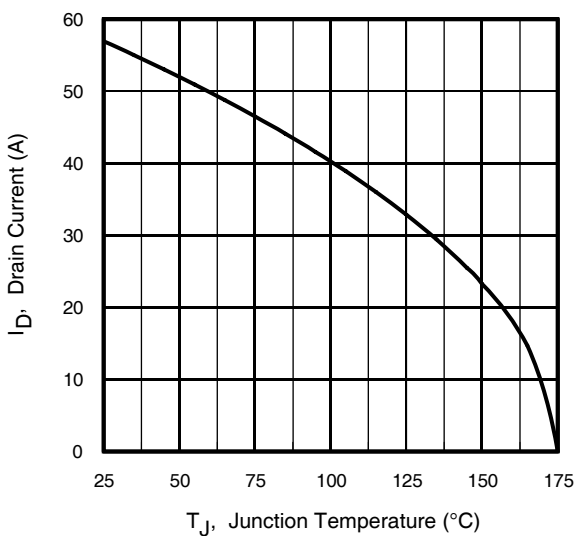
**Fig 8.** Typical Source-Drain Diode Forward Voltage



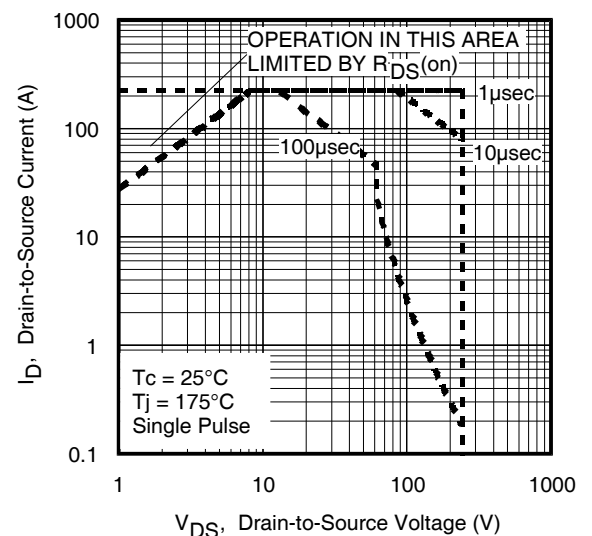
**Fig 9.** Typical Capacitance vs. Drain-to-Source Voltage



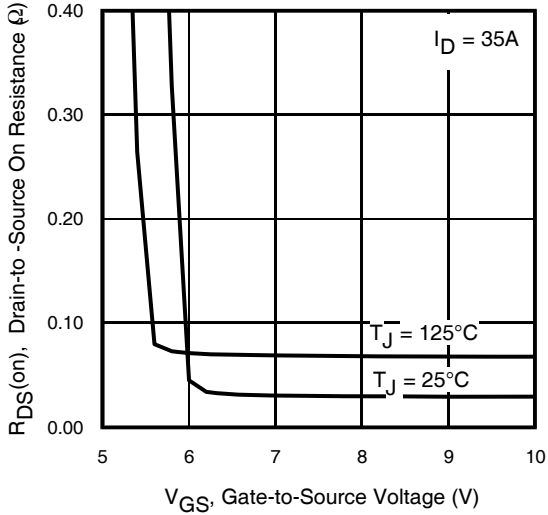
**Fig 10.** Typical Gate Charge vs. Gate-to-Source Voltage



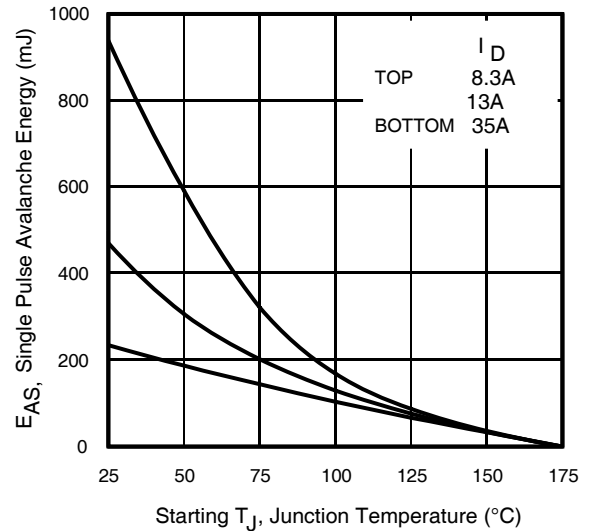
**Fig 11.** Maximum Drain Current vs. Case Temperature



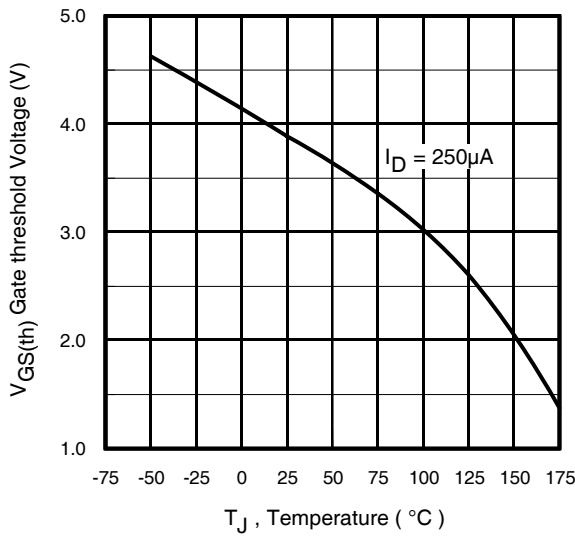
**Fig 12.** Maximum Safe Operating Area



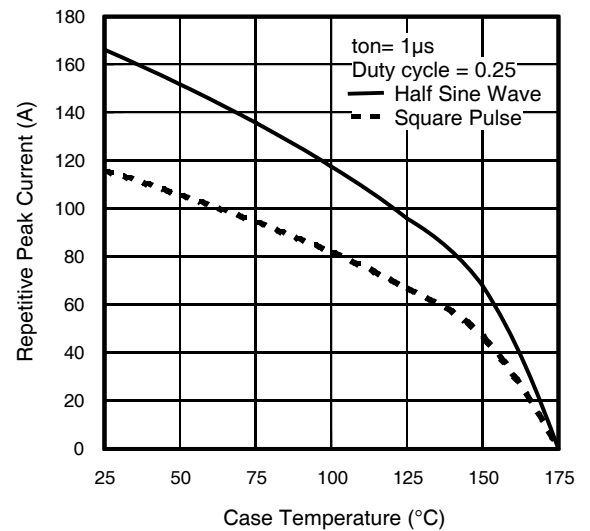
**Fig 13.** On-Resistance Vs. Gate Voltage



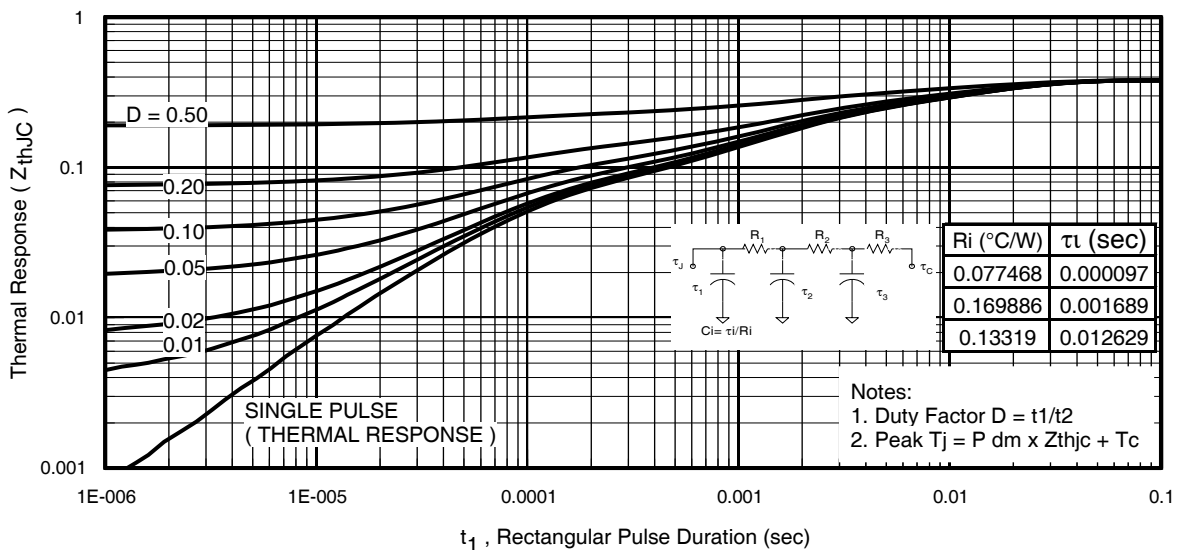
**Fig 14.** Maximum Avalanche Energy Vs. Temperature



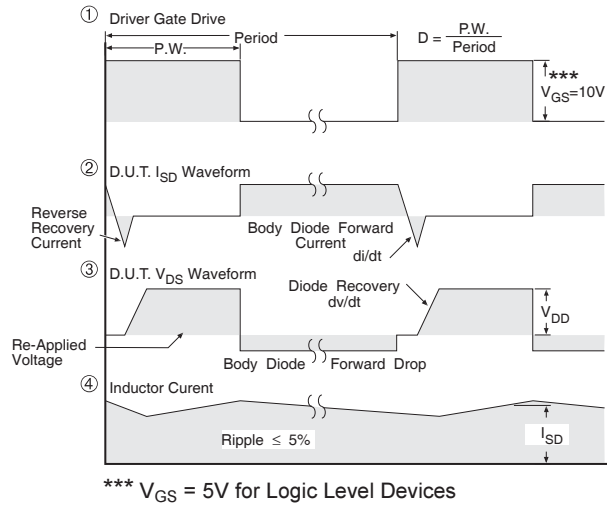
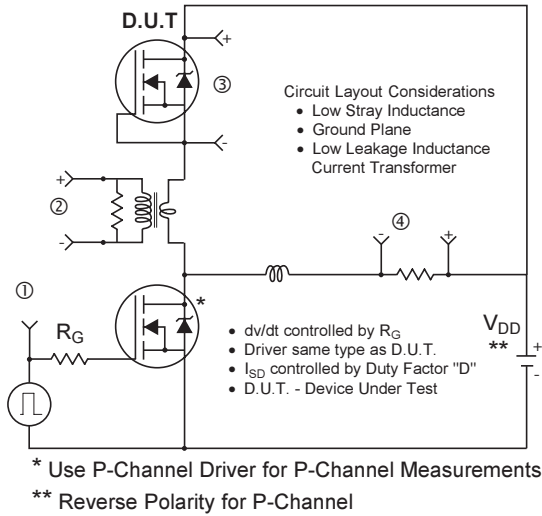
**Fig 15.** Threshold Voltage vs. Temperature



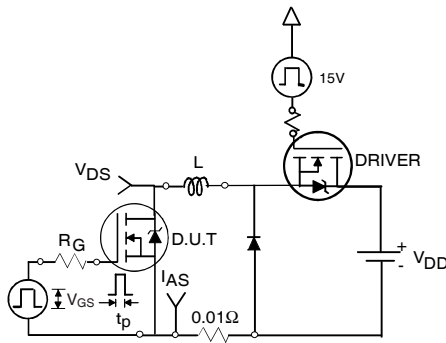
**Fig 16.** Typical Repetitive peak Current vs. Case temperature



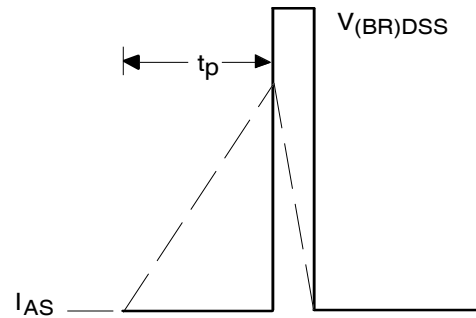
**Fig 17.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



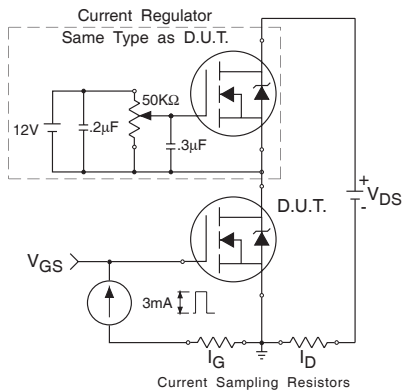
**Fig 18.** Diode Reverse Recovery Test Circuit for HEXFET® Power MOSFETs



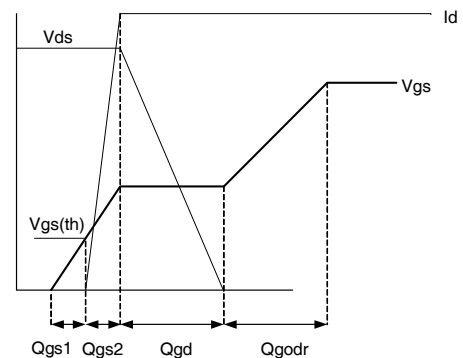
**Fig 19a.** Unclamped Inductive Test Circuit



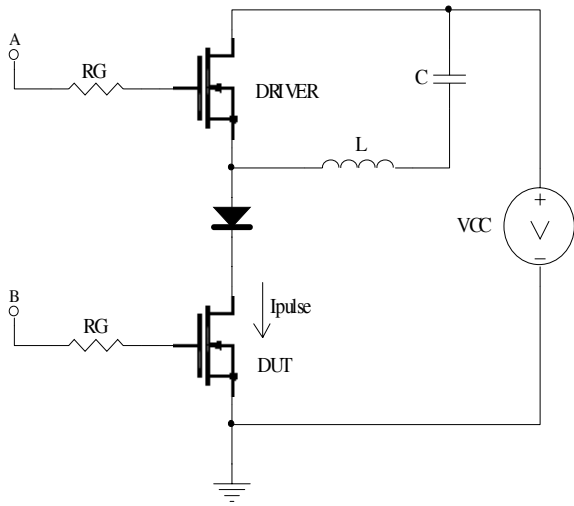
**Fig 19b.** Unclamped Inductive Waveforms



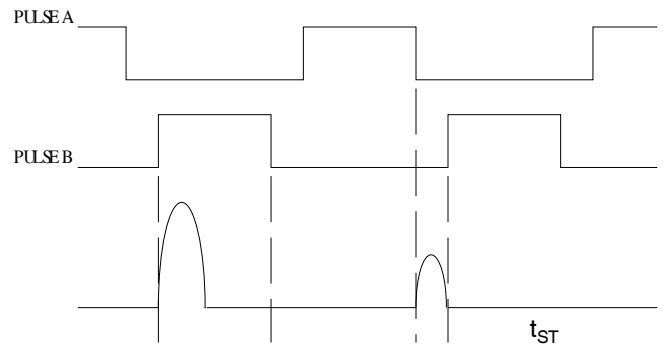
**Fig 20a.** Gate Charge Test Circuit



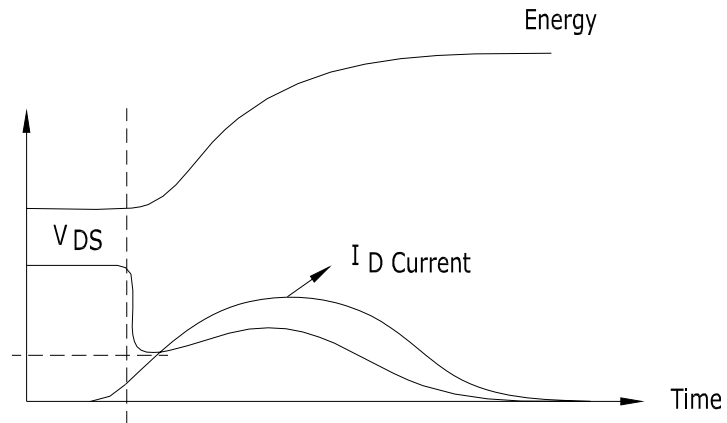
**Fig 20b.** Gate Charge Waveform



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



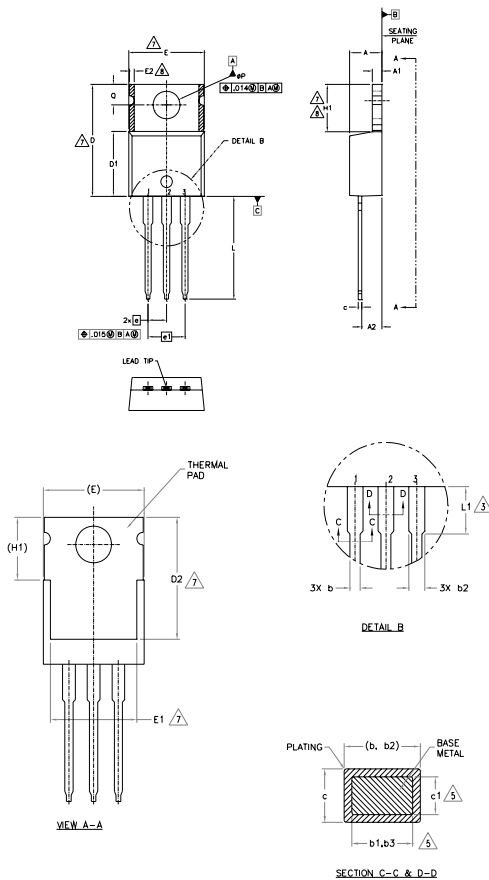
**Fig 21b.**  $t_{st}$  Test Waveforms



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

# IRFB4332PbF

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



- NOTES:
- 1.- DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
  - 2.- DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
  - 3.- LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
  - 4.- DIMENSION D, D1 & 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, b3 & 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.
  - 9.- OUTLINE CONFORMS TO JEDEC TO-220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.83	.140	.190	
A1	0.51	1.40	.020	.055	
A2	2.03	2.92	.080	.115	
b	0.38	1.01	.015	.040	5
b1	0.38	0.97	.015	.038	5
b2	1.14	1.78	.045	.070	5
b3	1.14	1.73	.045	.068	5
c	0.36	0.61	.014	.024	5
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	5
D2	11.68	12.88	.460	.507	7
E	9.65	10.67	.380	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	-	0.76	-	.030	8
e	2.54 BSC		.100 BSC		
ef	5.08 BSC		.200 BSC		
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	3.56	4.06	.140	.160	3
ØP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	

**LEAD ASSIGNMENTS**

**HEBEET**

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

**IGBTs CoPACK**

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

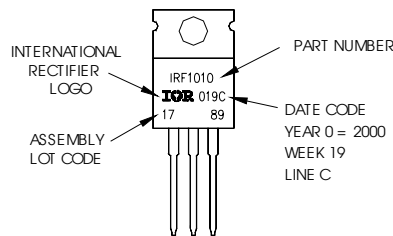
**DIODES**

- 1- ANODE
- 2- CATHODE
- 3- ANODE

## 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  $T_J = 25^\circ\text{C}$ ,  $L = 0.39\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 35\text{A}$ .
- 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,  $t_{on} = 1\mu\text{sec}$ .
- ⑥ Applicable to Sustain and Energy Recovery applications.

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.