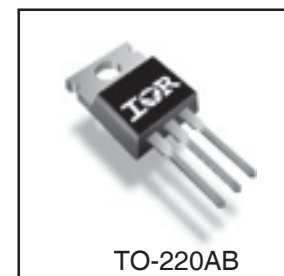
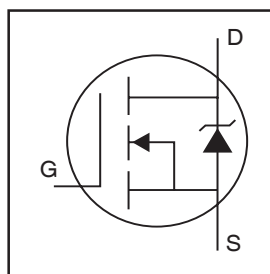


**Features**

- 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	230	V
$V_{DS}$ (Avalanche) typ.	276	V
$R_{DS(ON)}$ typ. @ 10V	31	mΩ
$I_{RP}$ max @ $T_C = 100^\circ\text{C}$	114	A
$T_J$ max	175	°C



**Description**

This HEXFET<sup>®</sup> 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
$I_D$ @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	56	A
$I_D$ @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	39	
$I_{DM}$	Pulsed Drain Current ①	220	
$I_{RP}$ @ $T_C = 100^\circ\text{C}$	Repetitive Peak Current ⑤	114	
$P_D$ @ $T_C = 25^\circ\text{C}$	Power Dissipation	370	W
$P_D$ @ $T_C = 100^\circ\text{C}$	Power Dissipation	190	
	Linear Derating Factor	2.5	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

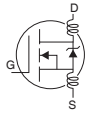
**Thermal Resistance**

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ④	—	0.402	°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	230	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	200	—	mV/°C	Reference to $25^\circ\text{C}, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	31	37	mΩ	$V_{GS} = 10V, I_D = 28A$ 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	—	—	5.0	μA	$V_{DS} = 184V, V_{GS} = 0V$
		—	—	150		$V_{DS} = 184V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
$g_{fs}$	Forward Transconductance	83	—	—	S	$V_{DS} = 25V, I_D = 39A$
$Q_g$	Total Gate Charge	—	120	170	nC	$V_{DD} = 115V, I_D = 39A, V_{GS} = 10V$ ③
$Q_{gd}$	Gate-to-Drain Charge	—	44	—		
$t_{st}$	Shoot Through Blocking Time	100	—	—	ns	$V_{DD} = 184V, V_{GS} = 15V, R_G = 4.7\Omega$
$E_{PULSE}$	Energy per Pulse	—	460	—	μJ	$L = 220nH, C = 0.4\mu F, V_{GS} = 15V$ $V_{DS} = 184V, R_G = 4.7\Omega, T_J = 25^\circ\text{C}$
		—	970	—		$L = 220nH, C = 0.4\mu F, V_{GS} = 15V$ $V_{DS} = 184V, R_G = 4.7\Omega, T_J = 100^\circ\text{C}$
$C_{iss}$	Input Capacitance	—	5510	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	480	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	220	—		$f = 1.0MHz,$
$C_{oss\ eff.}$	Effective Output Capacitance	—	340	—		$V_{GS} = 0V, V_{DS} = 0V\ to\ 184V$
$L_D$	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	—		

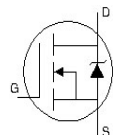


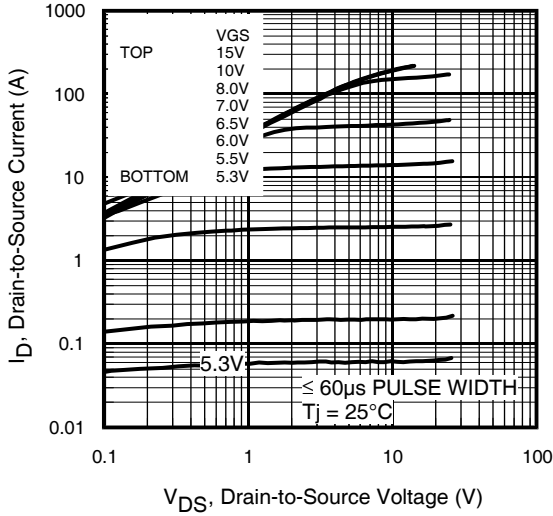
## Avalanche Characteristics

	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ②	—	250	mJ
$E_{AR}$	Repetitive Avalanche Energy ①	—	39	mJ
$V_{DS(Avalanche)}$	Repetitive Avalanche Voltage ①	276	—	V
$I_{AS}$	Avalanche Current ②	—	39	A

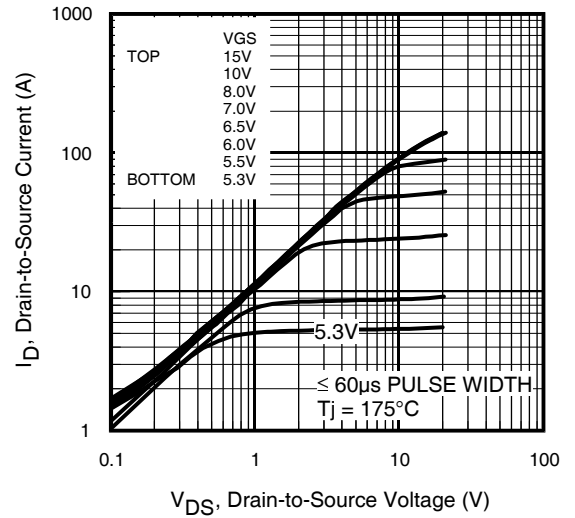
## Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S @ T_C = 25^\circ\text{C}$	Continuous Source Current (Body Diode)	—	—	56	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	220		
$V_{SD}$	Diode Forward Voltage	—	—	1.0	V	$T_J = 25^\circ\text{C}, I_S = 39A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	190	280	ns	$T_J = 25^\circ\text{C}, I_F = 39A, V_{DD} = 50V$
$Q_{rr}$	Reverse Recovery Charge	—	760	1140	nC	$di/dt = 100A/\mu s$ ③

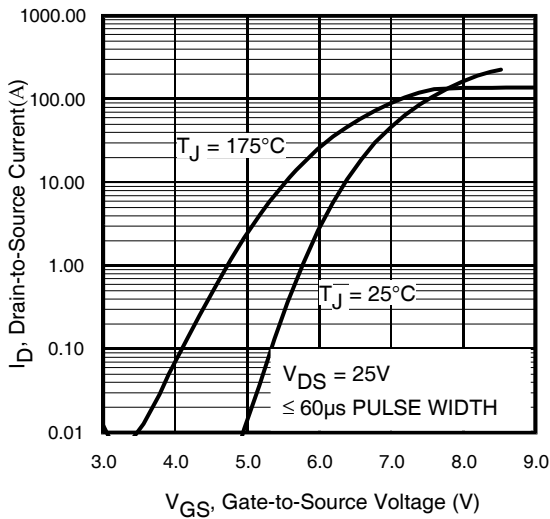




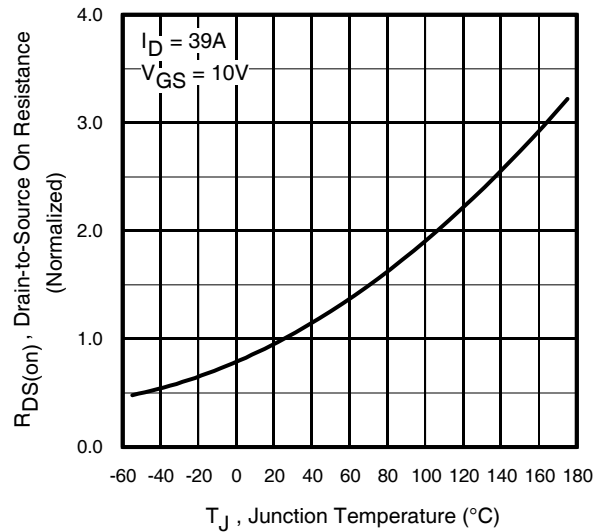
**Fig 1.** Typical Output Characteristics



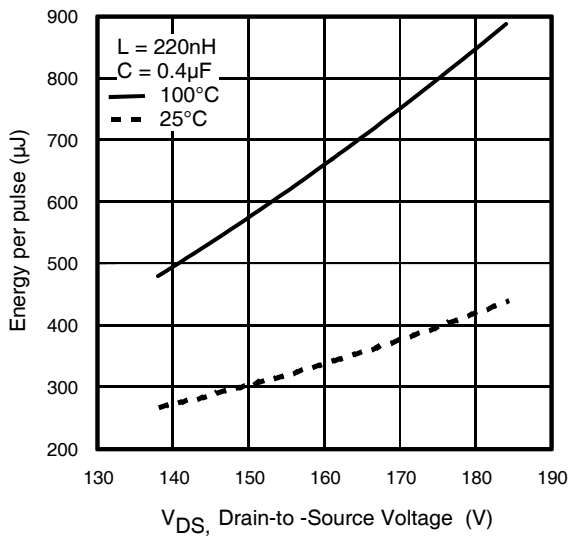
**Fig 2.** Typical Output Characteristics



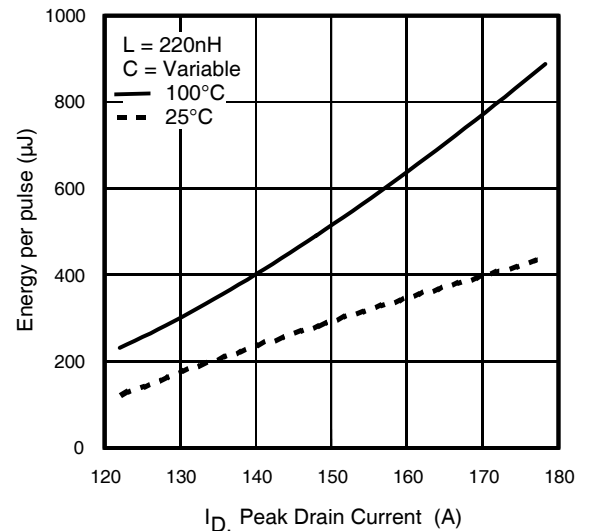
**Fig 3.** Typical Transfer Characteristics



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



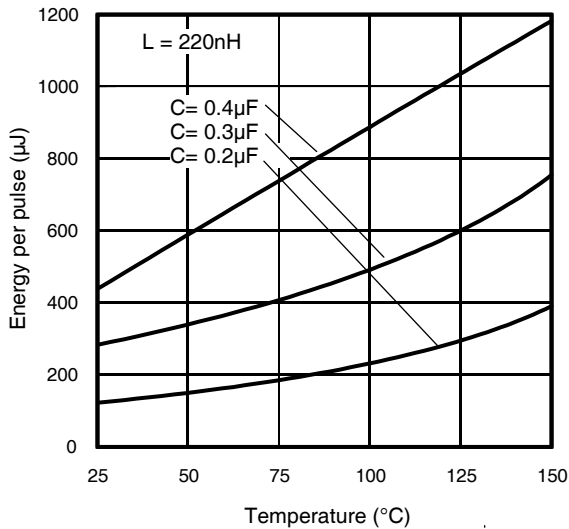
**Fig 5.** Typical  $E_{PULSE}$  vs. Drain-to-Source Voltage



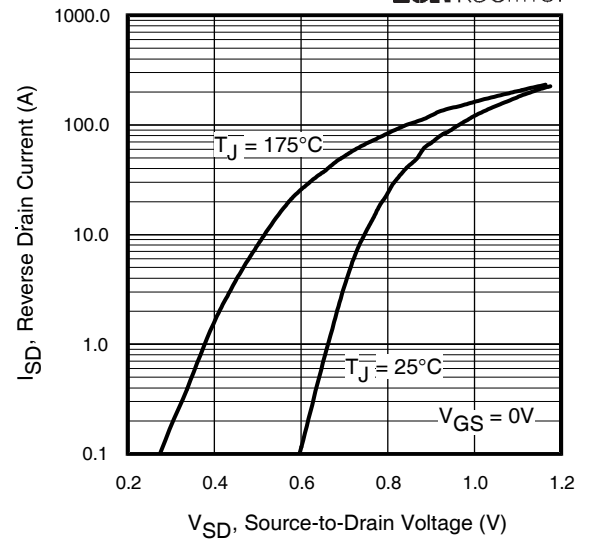
**Fig 6.** Typical  $E_{PULSE}$  vs. Drain Current

# IRFB4233PbF

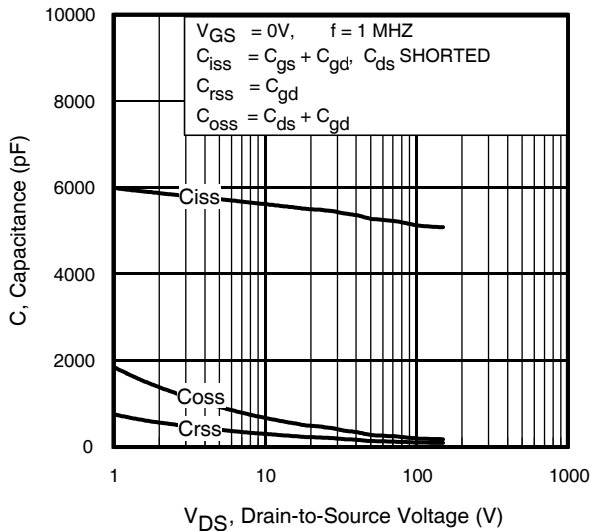
International  
**IR** Rectifier



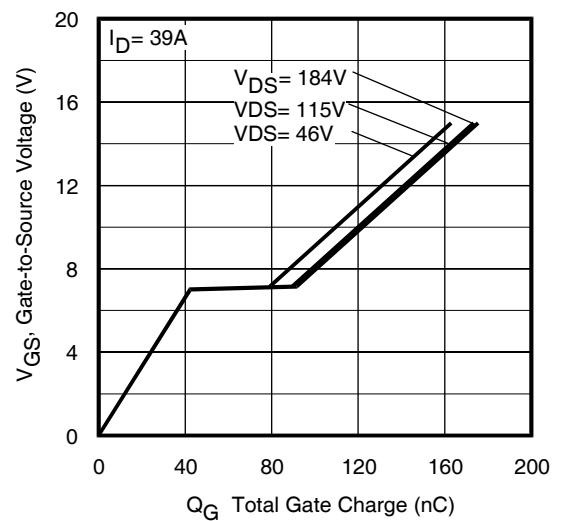
**Fig 7.** Typical  $E_{PULSE}$  vs. Temperature



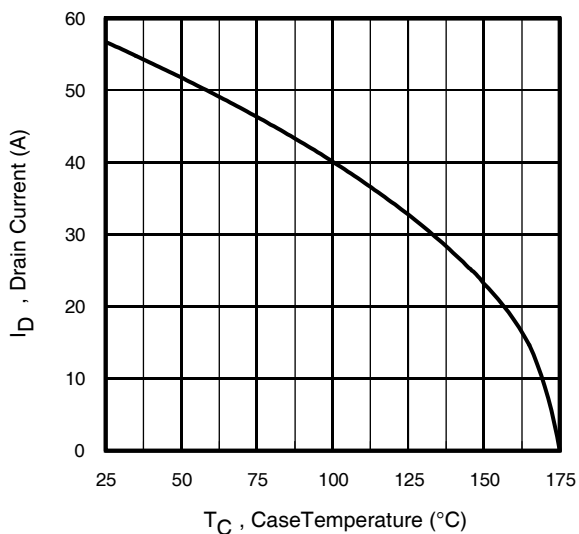
**Fig 8.** Typical Source-Drain Diode Forward Voltage



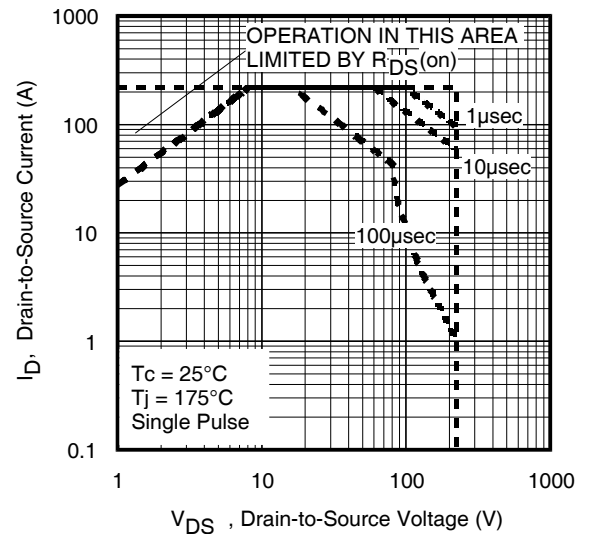
**Fig 9.** Typical Capacitance vs. Drain-to-Source Voltage



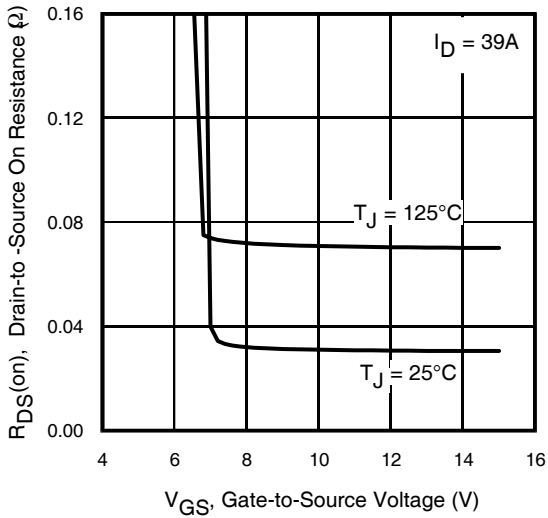
**Fig 10.** Typical Gate Charge vs. Gate-to-Source Voltage



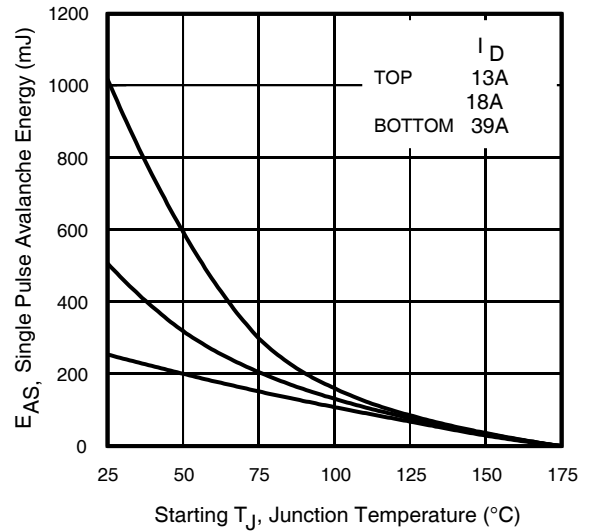
**Fig 11.** Maximum Drain Current vs. Case Temperature



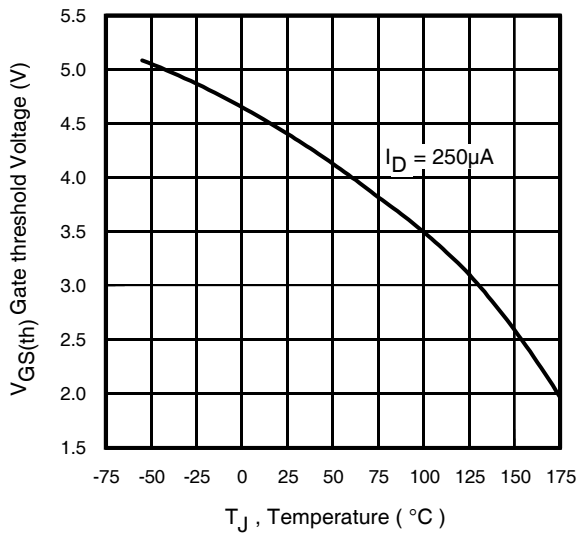
**Fig 12.** Maximum Safe Operating Area



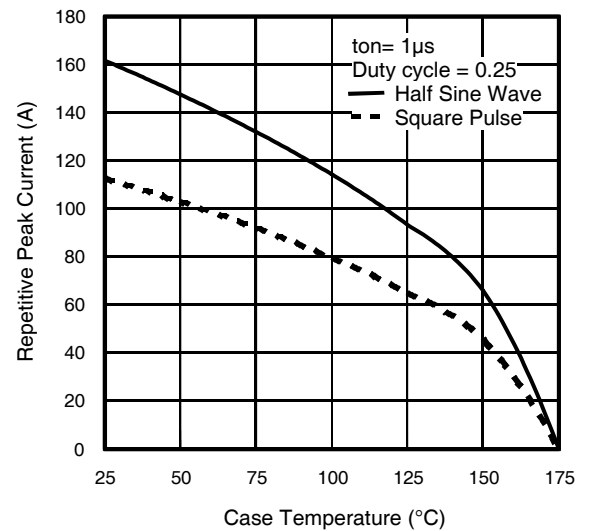
**Fig 13.** On-Resistance Vs. Gate Voltage



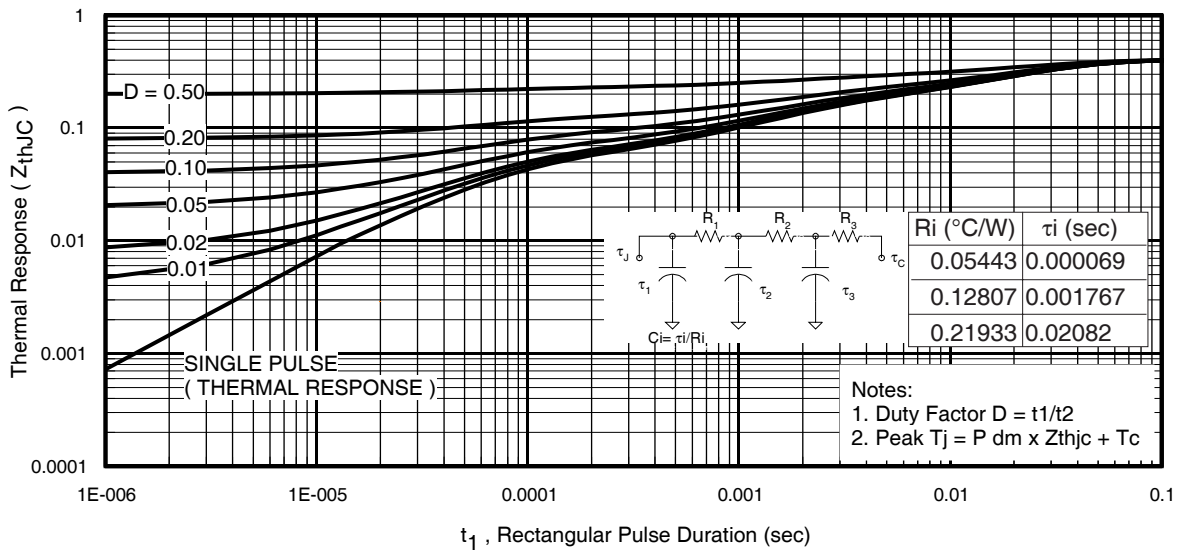
**Fig 14.** Maximum Avalanche Energy Vs. Temperature



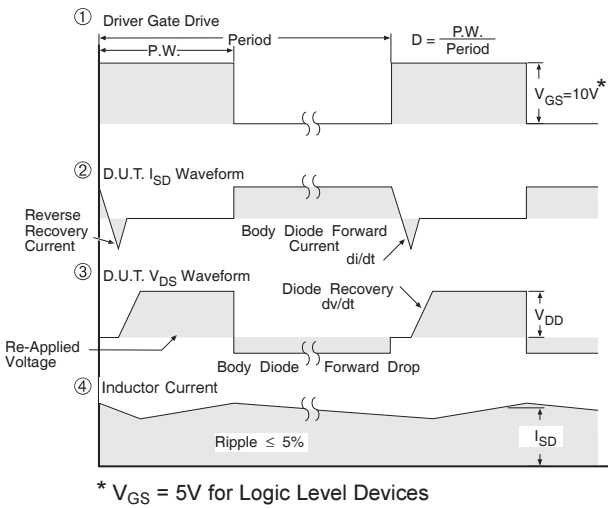
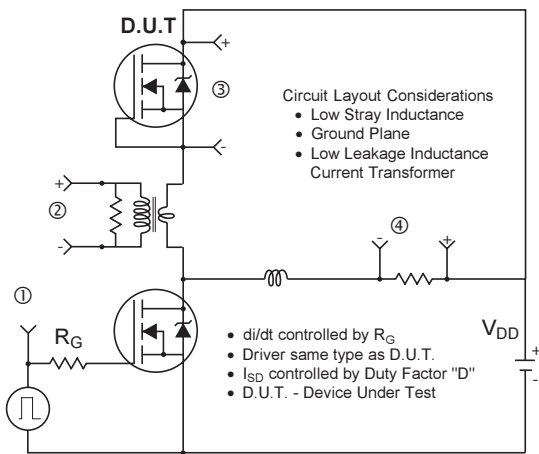
**Fig 15.** Threshold Voltage vs. Temperature



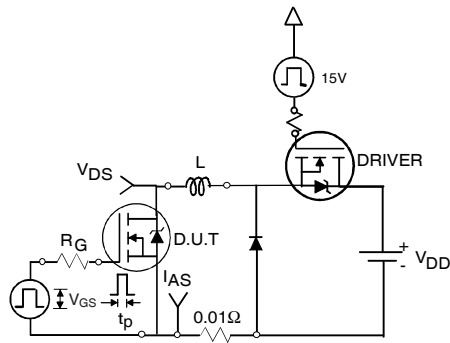
**Fig 16.** Typical Repetitive peak Current vs. Case temperature



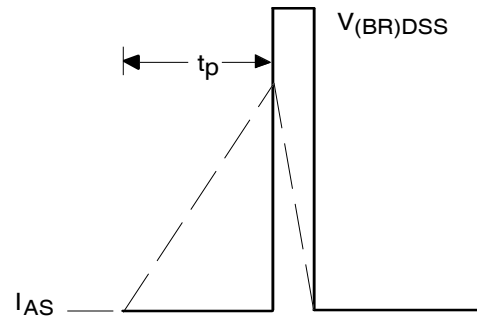
**Fig 17.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



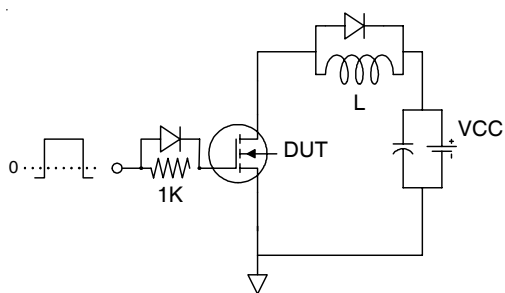
**Fig 18.** Diode Reverse Recovery Test Circuit for N-Channel HEXFET<sup>®</sup> Power MOSFETs



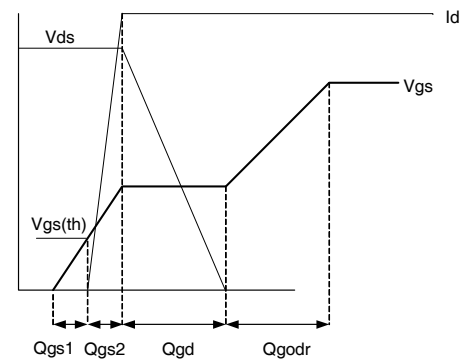
**Fig 19a.** Unclamped Inductive Test Circuit



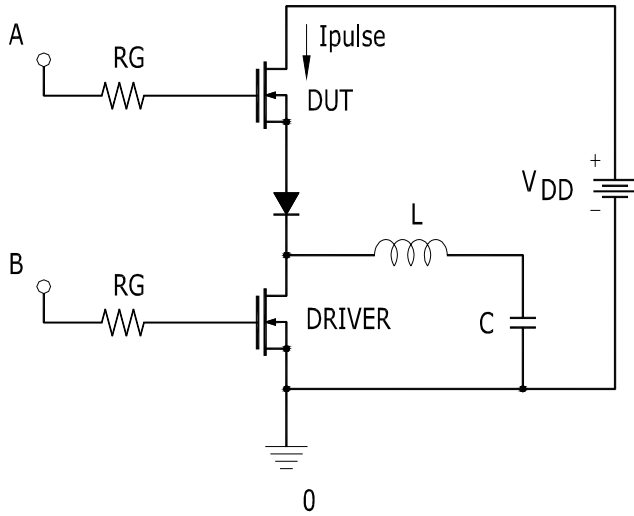
**Fig 19b.** Unclamped Inductive Waveforms



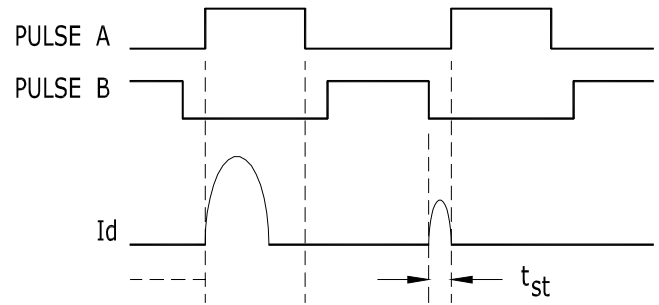
**Fig 20a.** Gate Charge Test Circuit



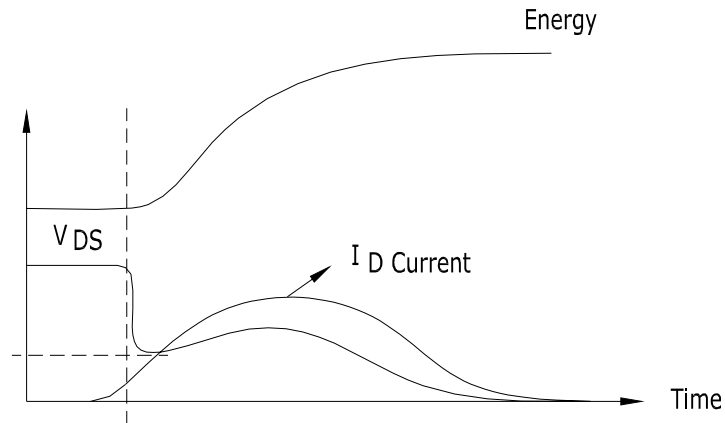
**Fig 20b.** Gate Charge Waveform



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

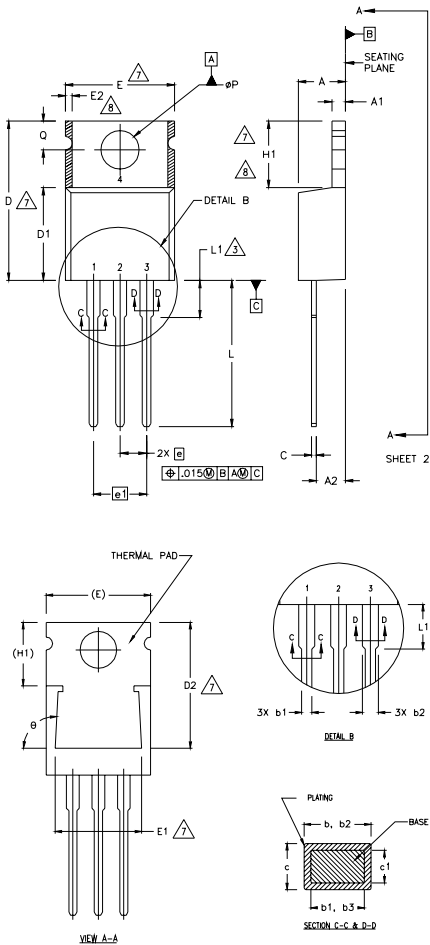


**Fig 21b.**  $t_{st}$  Test Waveforms



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

## 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**

**HEXKEET**

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

**IGBTs, CoPACK**

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

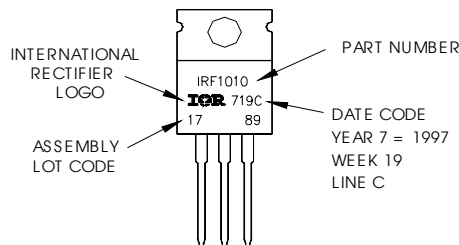
**DIODES**

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

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.82	.140	.190	
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
φP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	
φ	90°-93°		90°-93°		

## TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010  
 LOT CODE 1789  
 ASSEMBLED ON WW 19, 1997  
 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  $T_J = 25^\circ\text{C}$ ,  $L = 0.34\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 39\text{A}$ .
- 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,  $t_{on} = 1\mu\text{sec}$ .

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.



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