

IRFI4321PbF

Applications

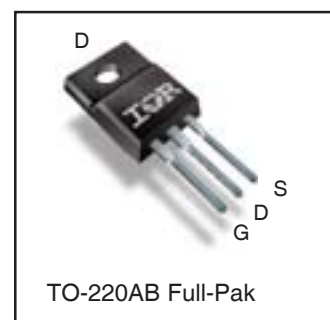
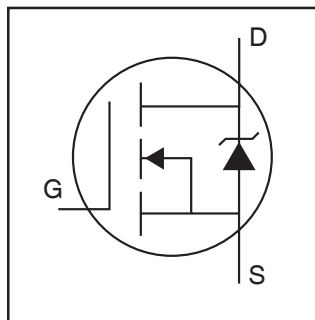
- Motion Control Applications
- High Efficiency Synchronous Rectification in SMPS
- Uninterruptible Power Supply
- Hard Switched and High Frequency Circuits

Benefits

- Low $R_{DS(on)}$ Reduces Losses
- Low Gate Charge Improves the Switching Performance
- Improved Diode Recovery Improves Switching & EMI Performance
- 30V Gate Voltage Rating Improves Robustness
- Fully Characterized Avalanche SOA

HEXFET® Power MOSFET

V_{DSS}	150V
$R_{DS(on)}$ typ. max.	12.2mΩ
	16mΩ
I_D	34A



G	D	S
Gate	Drain	Source

Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	34	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	21	
I_{DM}	Pulsed Drain Current ①	140	
P_D @ $T_C = 25^\circ\text{C}$	Maximum Power Dissipation	46	W
	Linear Derating Factor	0.37	W/°C
V_{GS}	Gate-to-Source Voltage	±30	V
E_{AS} (Thermally limited)	Single Pulse Avalanche Energy ②	170	mJ
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Soldering Temperature, for 10 seconds (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	—	2.73	°C/W
$R_{\theta JA}$	Junction-to-Ambient ④	—	65	

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	150	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	190	—	mV/°C	Reference to 25°C , $I_D = 1mA$ ③
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	12.2	16	mΩ	$V_{GS} = 10V, I_D = 20A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 150V, V_{GS} = 0V$
		—	—	1.0	mA	$V_{DS} = 150V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100	nA	$V_{GS} = -20V$
$R_{G(int)}$	Internal Gate Resistance	—	0.8	—	Ω	

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	50	—	—	S	$V_{DS} = 50V, I_D = 20A$
Q_g	Total Gate Charge	—	73	110	nC	$I_D = 20A$
Q_{gs}	Gate-to-Source Charge	—	24	—	nC	$V_{DS} = 75V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	20	—	nC	$V_{GS} = 10V$ ③
$t_{d(on)}$	Turn-On Delay Time	—	18	—	ns	$V_{DD} = 75V$
t_r	Rise Time	—	29	—	ns	$I_D = 20A$
$t_{d(off)}$	Turn-Off Delay Time	—	27	—	ns	$R_G = 2.5\Omega$
t_f	Fall Time	—	20	—	ns	$V_{GS} = 10V$ ③
C_{iss}	Input Capacitance	—	4440	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	390	—	pF	$V_{DS} = 50V$
C_{rss}	Reverse Transfer Capacitance	—	84	—	pF	$f = 1.0MHz$

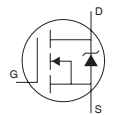
Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	34	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	140	A	
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 20A, V_{GS} = 0V$ ③
t_{rr}	Reverse Recovery Time	—	86	130	ns	$I_D = 20A$
Q_{rr}	Reverse Recovery Charge	—	310	470	nC	$V_R = 128V,$
I_{RRM}	Reverse Recovery Current	—	6.7	—	A	$di/dt = 100A/\mu s$ ③
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Limited by T_{Jmax} , starting $T_J = 25^\circ\text{C}$, $L = 0.85mH$
 $R_G = 25\Omega$, $I_{AS} = 20A$, $V_{GS} = 10V$. Part not recommended for use above this value.

- ③ Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.
- ④ R_θ is measured at T_J approximately 90°C



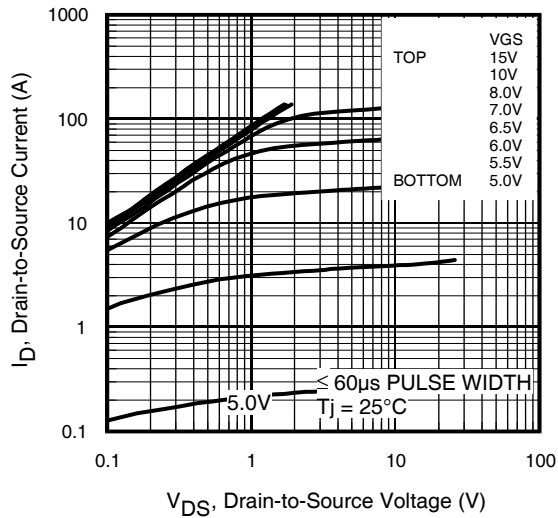


Fig 1. Typical Output Characteristics

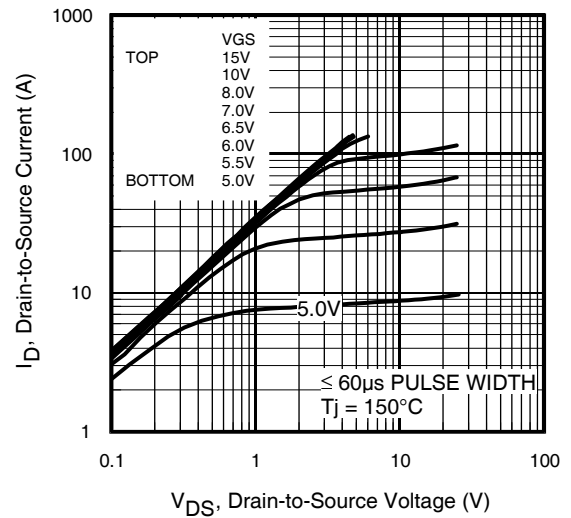


Fig 2. Typical Output Characteristics

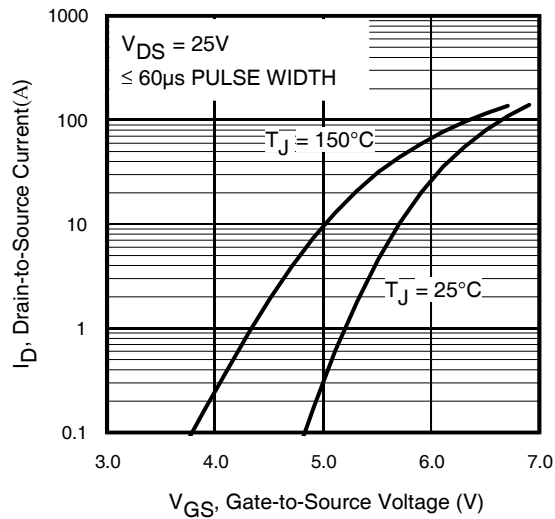


Fig 3. Typical Transfer Characteristics

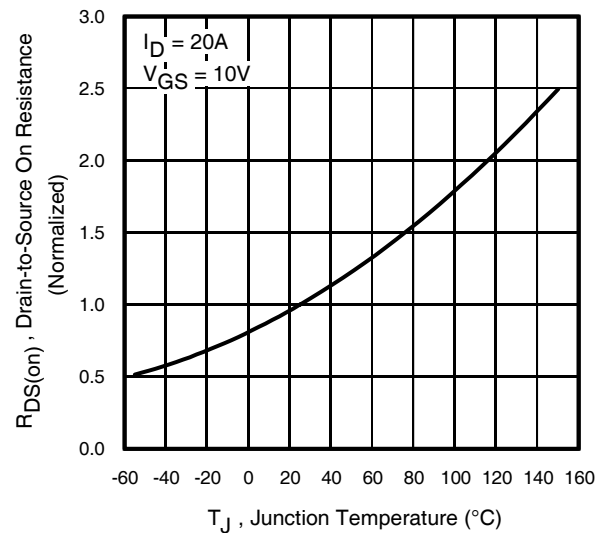


Fig 4. Normalized On-Resistance vs. Temperature

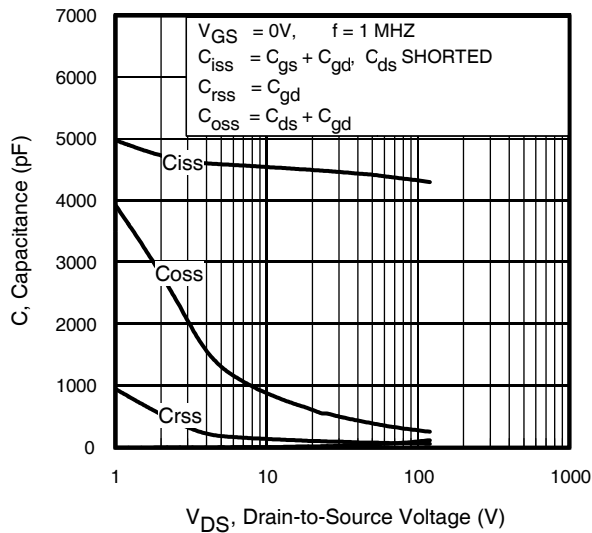


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

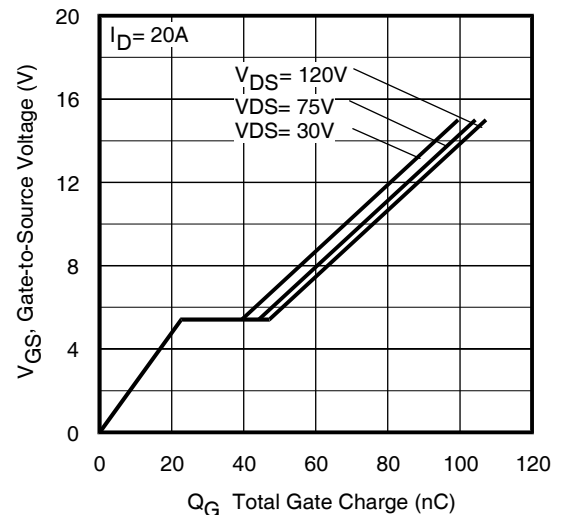


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

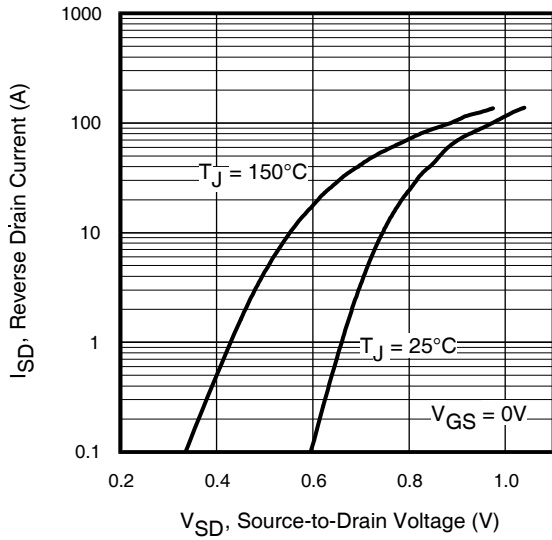


Fig 7. Typical Source-Drain Diode Forward Voltage

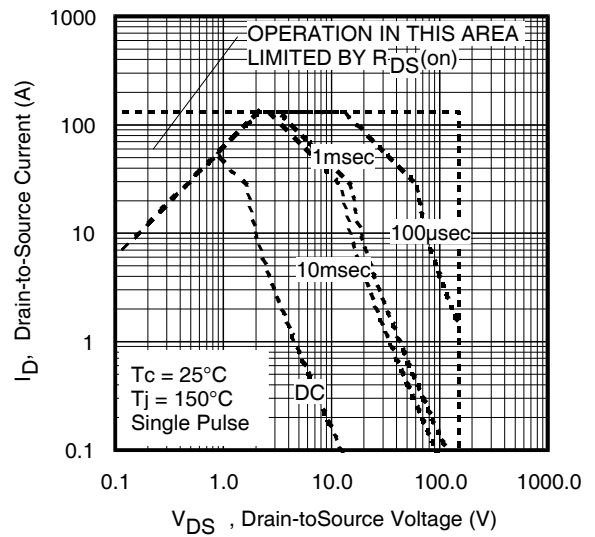


Fig 8. Maximum Safe Operating Area

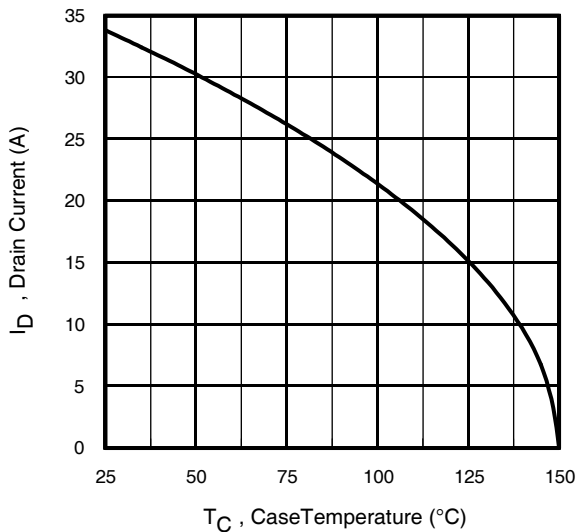


Fig 9. Maximum Drain Current vs. Case Temperature

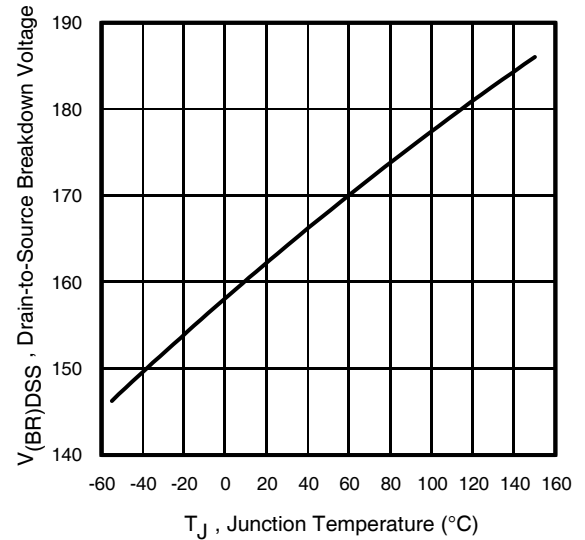


Fig 10. Drain-to-Source Breakdown Voltage

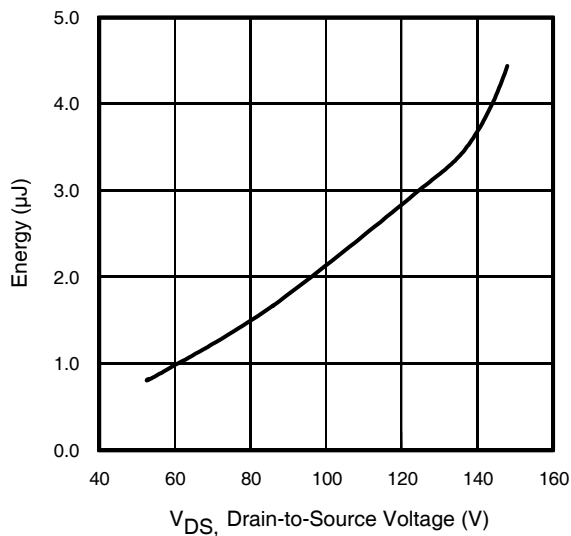


Fig 11. Typical C_{OSS} Stored Energy

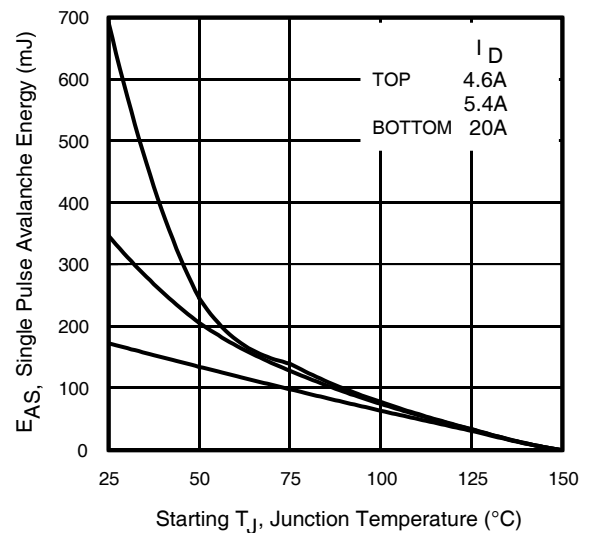


Fig 12. Maximum Avalanche Energy Vs. Drain Current
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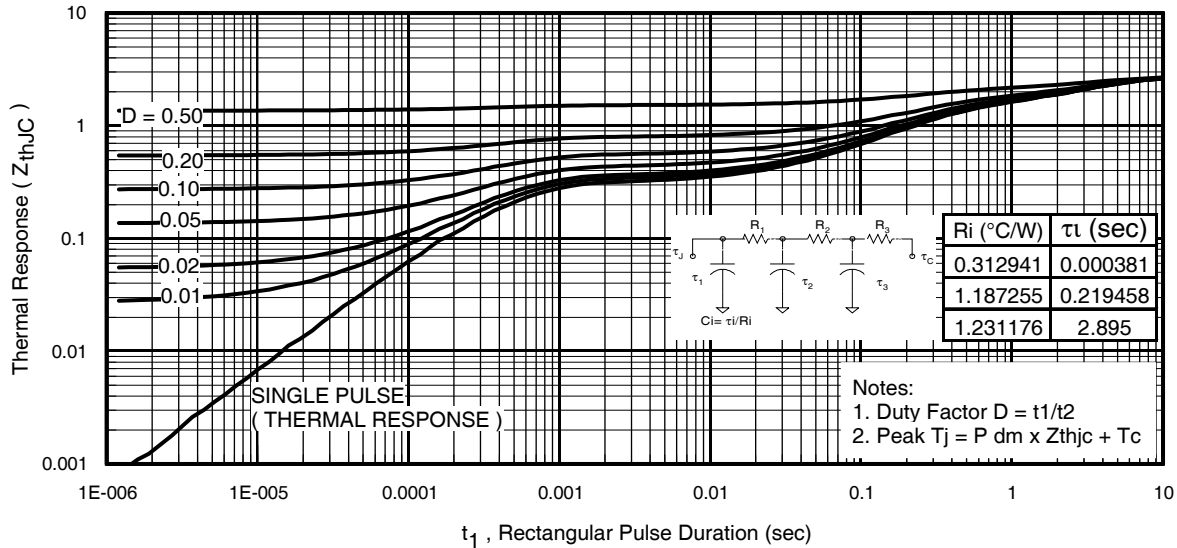


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

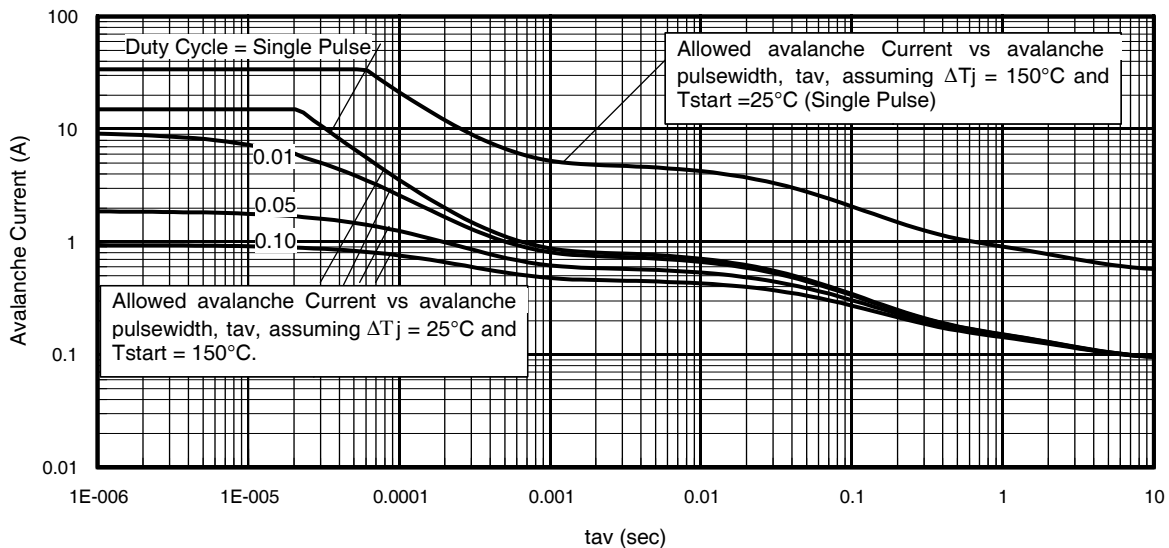
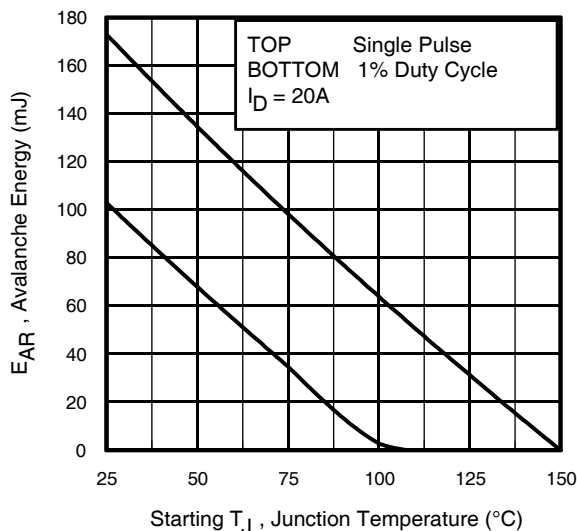


Fig 14. Typical Avalanche Current vs. Pulsewidth



Notes on Repetitive Avalanche Curves, Figures 14, 15:
(For further info, see AN-1005 at 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 T_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 16a, 16b.
4. $P_{D(ave)}$ = Average power dissipation per single avalanche pulse.
5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6. I_{av} = Allowable avalanche current.
7. ΔT = 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 Figures 13)

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

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

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

Fig 15. Maximum Avalanche Energy vs. Temperature

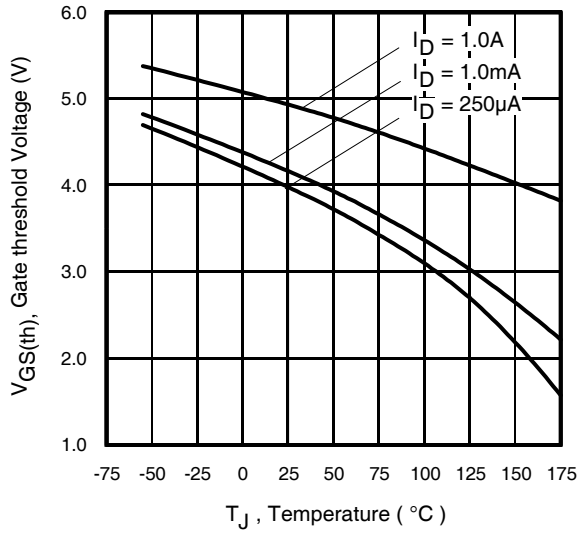


Fig 16. Threshold Voltage Vs. Temperature

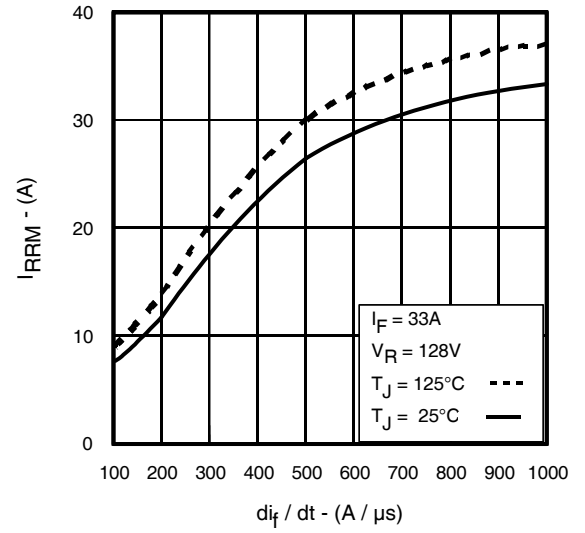


Fig. 17 - Typical Recovery Current vs. di_f/dt

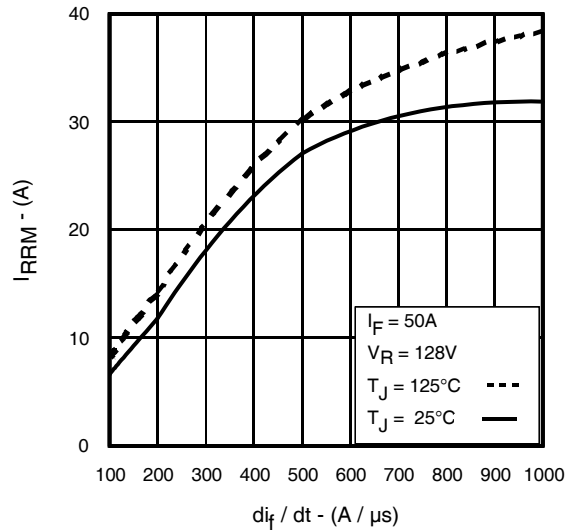


Fig. 18 - Typical Recovery Current vs. di_f/dt

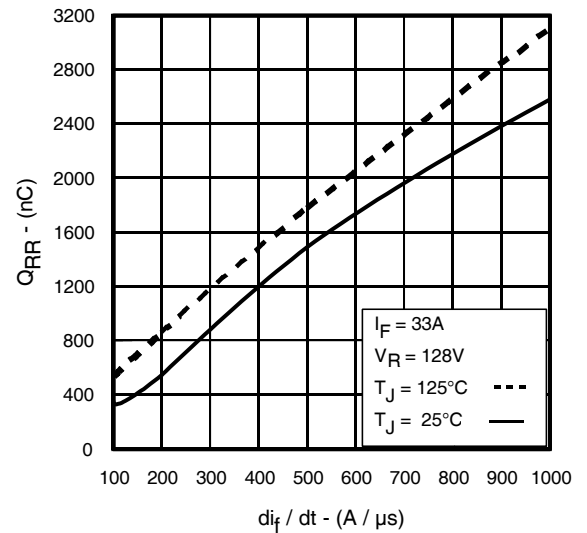


Fig. 19 - Typical Stored Charge vs. di_f/dt

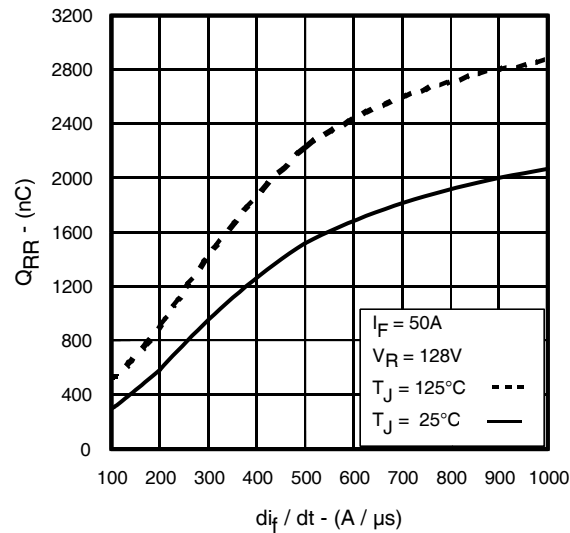
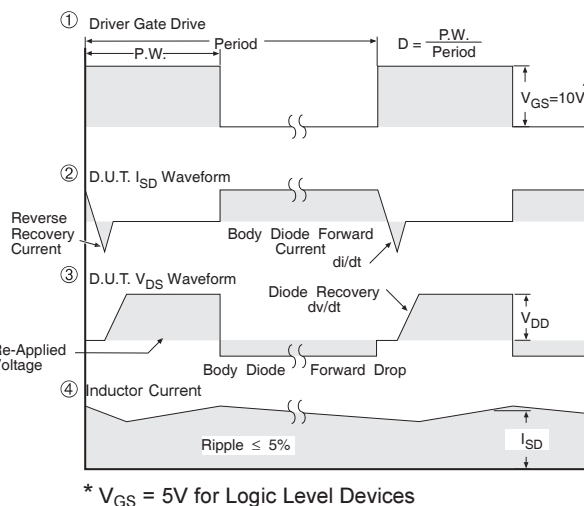


Fig. 20 - Typical Stored Charge vs. di_f/dt

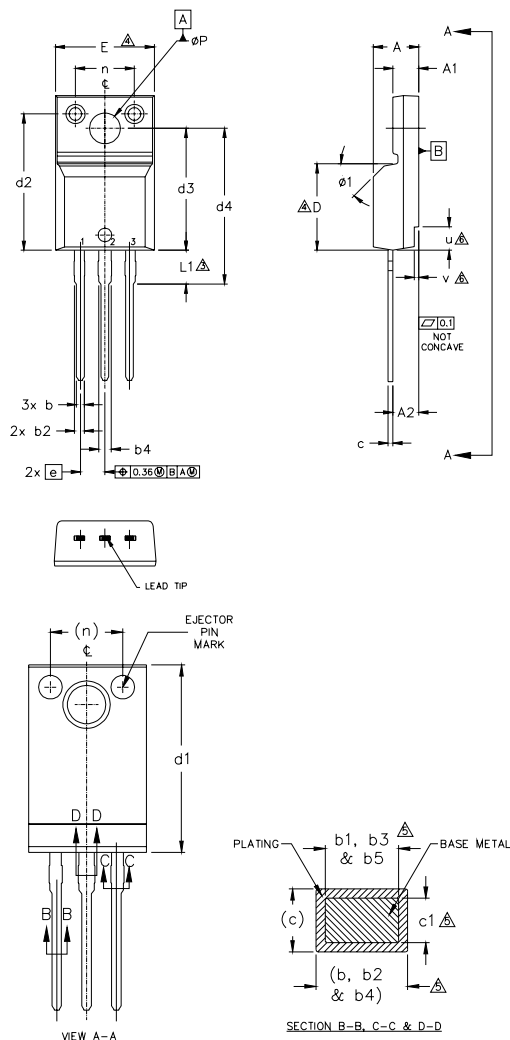


The diagram shows a MOSFET circuit. A pulse generator (represented by a circle with a square wave) is connected to the gate of the MOSFET. The gate voltage is labeled V_{GS} . The pulse generator's output is specified as "Pulse Width < 1 μ s" and "Duty Factor < 0.1%". The MOSFET is connected in a common-source configuration. The drain is connected to a load inductor L_D and a drain supply voltage V_{DD} . The drain voltage is labeled V_{DS} . The MOSFET is labeled "D.U.T." (Device Under Test).

The diagram shows a circuit for testing a Device Under Test (DUT), represented by a circle with a triangle pointing out. The input is a square wave pulse labeled '0'. The base of the DUT is connected to this input through a 1K resistor and a diode. The emitter of the DUT is grounded. The collector of the DUT is connected to a load inductor L and a diode in parallel, which is then connected to a VCC supply through a capacitor and a diode.

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



NOTES:

- 1.0 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
- 2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- 3.0 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- 4.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTER MOST EXTREMES OF THE PLASTIC BODY.
- 5.0 DIMENSION b1, b3, b5 & c1 APPLY TO BASE METAL ONLY.
- 6.0 STEP OPTIONAL ON PLASTIC BODY DEFINED BY DIMENSIONS u & v.
- 7.0 CONTROLLING DIMENSION : INCHES.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.57	4.83	.180	.190	5
A1	2.57	2.83	.101	.111	
A2	2.41	2.92	.095	.115	
b	0.62	.094	0.24	.037	
b1	0.62	0.89	.024	0.35	
b2	0.76	1.27	.030	.050	5
b3	0.76	1.22	.030	.048	
b4	1.02	1.52	.040	.060	
b5	1.02	1.47	.040	.058	5
c	0.33	0.63	.013	.025	5
c1	0.33	0.58	.013	.023	
D	8.65	9.80	.341	.386	
d1	15.80	16.12	.622	.635	4
d2	13.97	14.22	.550	.560	
d3	12.30	12.92	.484	.509	
d4	8.64	9.91	.340	.390	
E	9.63	10.63	.379	.419	
e	2.54 BSC		.100 BSC		3
L	13.20	13.72	.520	.540	
L1	3.10	2.31	.122	.138	
n	6.05	6.15	.238	.242	
øP	3.05	3.45	.120	.136	
u	2.40	2.50	.094	.098	6
v	0.40	0.50	.016	.020	6
ø1	—	45°	—	45°	

LEAD ASSIGNMENTS

HEXFET

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

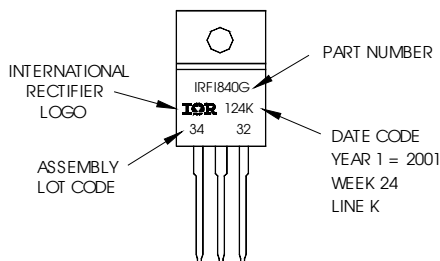
IGBTs, CoPACK

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

TO-220AB Full-Pak Part Marking Information

EXAMPLE: THIS IS AN IRF1840G
WITH ASSEMBLY
LOT CODE 3432
ASSEMBLED ON WW24, 2001
IN THE ASSEMBLY LINE "K"

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



TO-220AB Full-Pak 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 Industrial 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 for sales contact information. 06/06

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