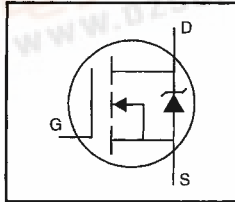# International IOR Rectifier

IRFI830G

HEXFET® Power MOSFET

- Isolated Package
- High Voltage Isolation= 2.5KVRMS ⑤
- Sink to Lead Creepage Dist.= 4.8mm
- Dynamic dv/dt Rating
- Low Thermal Resistance

$V_{DSS} = 500V$

$R_{DS(on)} = 1.5\Omega$

$I_D = 3.1A$

Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-220 Fullpak eliminates the need for additional insulating hardware in commercial-industrial applications. The moulding compound used provides a high isolation capability and a low thermal resistance between the tab and external heatsink. This isolation is equivalent to using a 100 micron mica barrier with standard TO-220 product. The Fullpak is mounted to a heatsink using a single clip or by a single screw fixing.

TO-220 FULLPAK
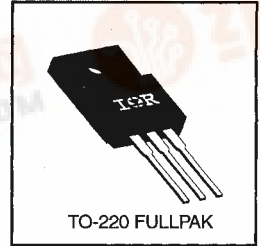
Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ $T_C = 25°C$	Continuous Drain Current, V_{GS} @ 10 V	3.1	A
I_D @ $T_C = 100°C$	Continuous Drain Current, V_{GS} @ 10 V	2.0	
I_{DM}	Pulsed Drain Current ①	12	
P_D @ $T_C = 25°C$	Power Dissipation	35	W
	Linear Derating Factor	0.28	W/°C
V_{GS}	Gate-to-Source Voltage	±20	V
E_{AS}	Single Pulse Avalanche Energy ②	180	mJ
I_{AR}	Avalanche Current ①	3.1	A
E_{AR}	Repetitive Avalanche Energy ①	3.5	mJ
dv/dt	Peak Diode Recovery dv/dt ③	3.5	V/ns
T_J	Operating Junction and	-55 to +150	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting Torque, 6-32 or M3 screw	10 lbf•in (1.1 N•m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	3.6	°C/W
$R_{\theta JA}$	Junction-to-Ambient	—	—	65	

DATA SHEETS

IRFI830G

Electrical Characteristics @ T$_J$ = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
V$_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	500	—	—	V	V$_{GS}$=0V, I$_D$= 250μA
ΔV$_{(BR)DSS}$/ΔT$_J$	Breakdown Voltage Temp. Coefficient	—	0.61	—	V/°C	Reference to 25°C, I$_D$= 1mA
R$_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	1.5	Ω	V$_{GS}$=10V, I$_D$=1.9A ④
V$_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	V$_{DS}$=V$_{GS}$, I$_D$= 250μA
g$_{fs}$	Forward Transconductance	2.0	—	—	S	V$_{DS}$=50V, I$_D$=1.9A ④
I$_{DSS}$	Drain-to-Source Leakage Current	—	—	25	μA	V$_{DS}$=500V, V$_{GS}$=0V
		—	—	250		V$_{DS}$=400V, V$_{GS}$=0V, T$_J$=125°C
I$_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	V$_{GS}$=20V
	Gate-to-Source Reverse Leakage	—	—	-100		V$_{GS}$=-20V
Q$_g$	Total Gate Charge	—	—	38		I$_D$=3.1A
Q$_{gs}$	Gate-to-Source Charge	—	—	5.0	nC	V$_{DS}$=400V
Q$_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	22		V$_{GS}$=10V See Fig. 6 and 13 ④
t$_{d(on)}$	Turn-On Delay Time	—	8.2	—		V$_{DD}$=250V
t$_r$	Rise Time	—	16	—		I$_D$=3.1A
t$_{d(off)}$	Turn-Off Delay Time	—	42	—	ns	R$_G$=12Ω
t$_f$	Fall Time	—	16	—		R$_D$=79Ω See Figure 10 ④
L$_D$	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6 mm (0.25in.) from package and center of die contact
L$_S$	Internal Source Inductance	—	7.5	—		
C$_{iss}$	Input Capacitance	—	610	—		V$_{GS}$=0V
C$_{oss}$	Output Capacitance	—	160	—	pF	V$_{DS}$= 25V
C$_{rss}$	Reverse Transfer Capacitance	—	68	—		f=1.0MHz See Figure 5
C	Drain to Sink Capacitance	—	12	—	pF	f=1.0MHz

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I$_S$	Continuous Source Current (Body Diode)	—	—	3.1	A	MOSFET symbol showing the integral reverse p-n junction diode.
I$_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	12		
V$_{SD}$	Diode Forward Voltage	—	—	1.6	V	T$_J$=25°C, I$_S$=3.1A, V$_{GS}$=0V ④
t$_{rr}$	Reverse Recovery Time	—	320	640	ns	T$_J$=25°C, I$_F$=3.1A
Q$_{rr}$	Reverse Recovery Charge	—	1.0	2.0	μC	di/dt=100A/μs ④
t$_{on}$	Forward Turn-On Time	Intrinsic turn-on time is neglegible (turn-on is dominated by L$_S$+L$_D$)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature (See Figure 11)

② V$_{DD}$=50V, starting T$_J$=25°C, L=33mH R$_G$=25Ω, I$_{AS}$=3.1A (See Figure 12)

③ I$_{SD}$≤3.1A, di/dt≤75A/μs, V$_{DD}$≤V$_{(BR)DSS}$, T$_J$≤150°C

④ Pulse width ≤ 300 μs; duty cycle ≤2%.

⑤ t=60s, f=60Hz
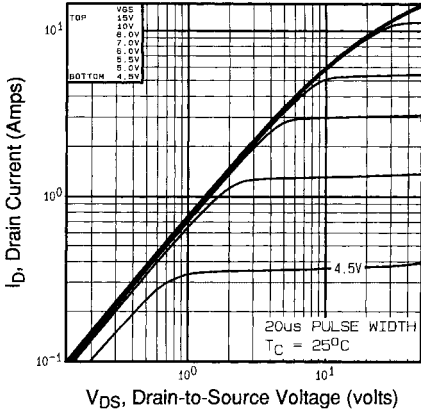
Fig 1. Typical Output Characteristics,
         T$_C$=25°C
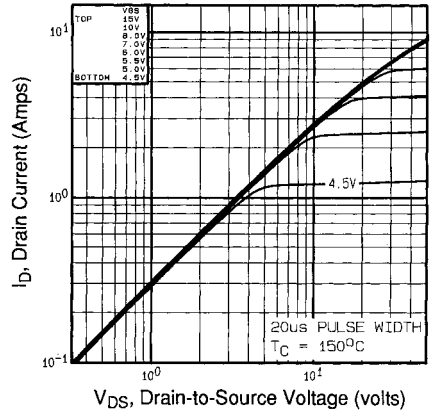

Fig 2. Typical Output Characteristics,
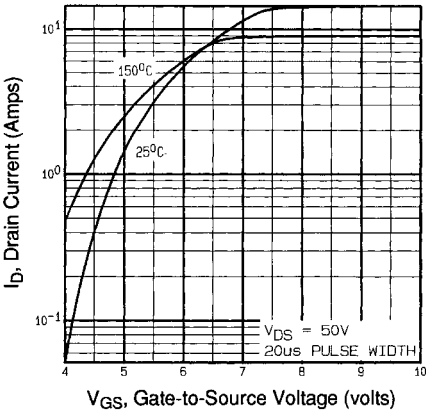   T$_C$=150°C

Fig 3. Typical Transfer Characteristics
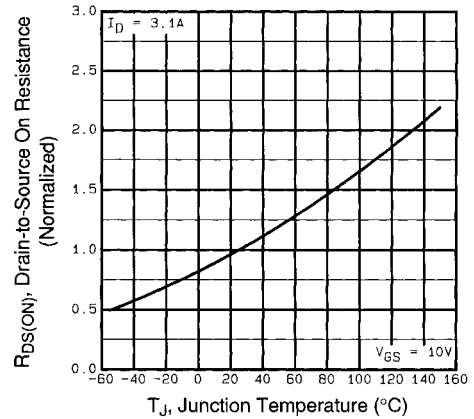
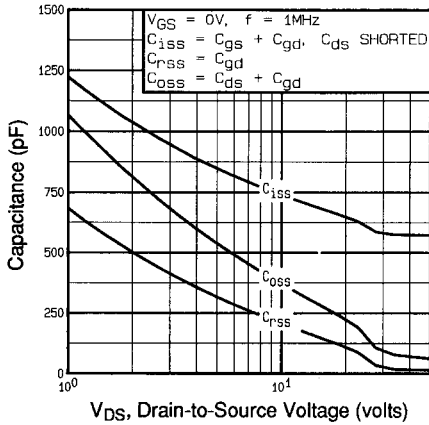

Fig 4. Normalized On-Resistance
         Vs. Temperature
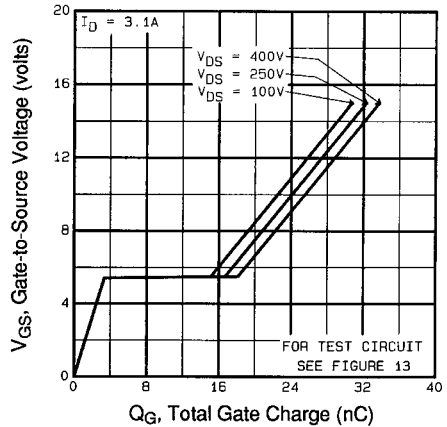
Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

$V_{GS} = 0V$, $f = 1MHz$
$C_{iss} = C_{gs} + C_{gd}$, C_{ds} SHORTED
$C_{rss} = C_{gd}$
$C_{oss} = C_{ds} + C_{gd}$

Capacitance (pF)

C_{iss}

C_{oss}

C_{rss}

V_{DS}, Drain-to-Source Voltage (volts)

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

$I_D = 3.1A$

$V_{DS} = 400V$
$V_{DS} = 250V$
$V_{DS} = 100V$

FOR TEST CIRCUIT
SEE FIGURE 13

V_{GS}, Gate-to-Source Voltage (volts)

Q_G, Total Gate Charge (nC)
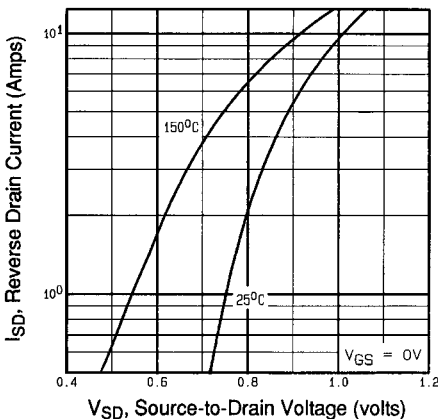
Fig 7. Typical Source-Drain Diode Forward Voltage

$150^{\circ}C$

$25^{\circ}C$

$V_{GS} = 0V$

I_{SD}, Reverse Drain Current (Amps)

V_{SD}, Source-to-Drain Voltage (volts)
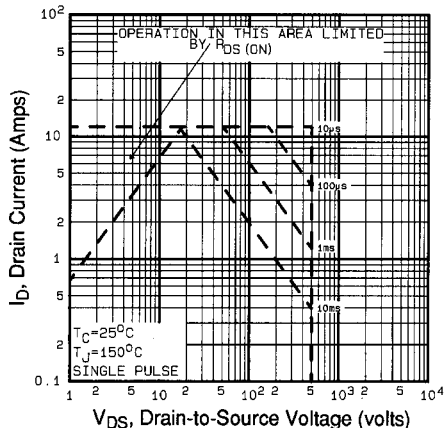
Fig 8. Maximum Safe Operating Area

OPERATION IN THIS AREA LIMITED BY R_{DS} (ON)

$10\mu s$
$100\mu s$
$1ms$
$10ms$

$T_C = 25^{\circ}C$
$T_J = 150^{\circ}C$
SINGLE PULSE

I_D, Drain Current (Amps)

V_{DS}, Drain-to-Source Voltage (volts)
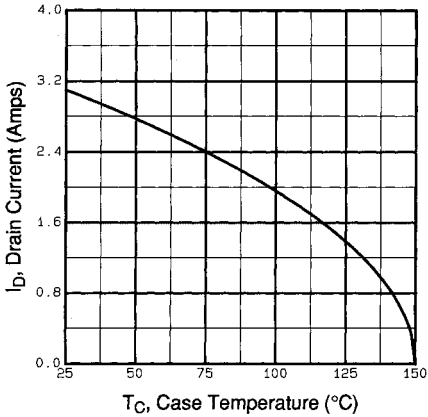
Fig 9. Maximum Drain Current Vs. Case Temperature
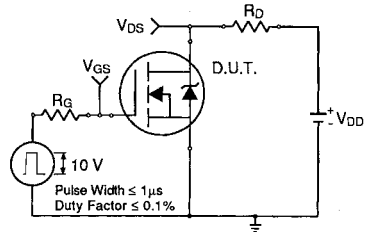

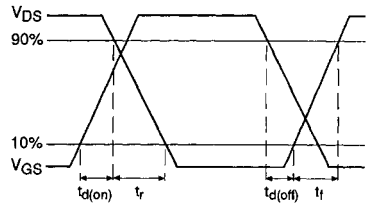**Fig 10a.** Switching Time Test Circuit

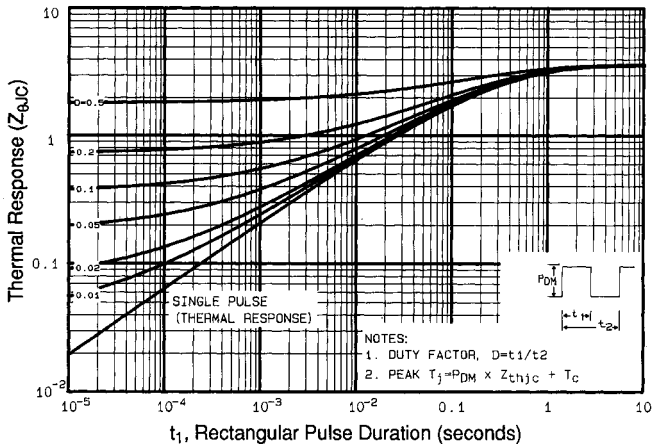

Fig 10b. Switching Time Waveforms

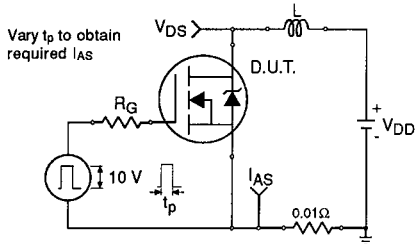**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

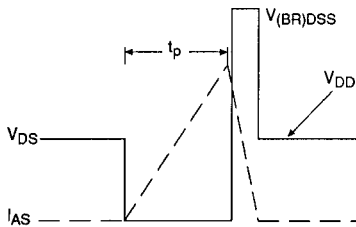# IRFI830G

Fig 12a. Unclamped Inductive Test Circuit
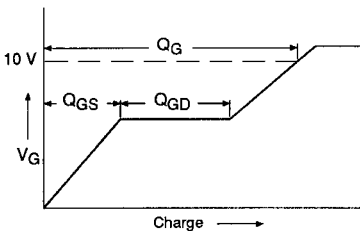

Fig 12b. Unclamped Inductive Waveforms

	I_D
TOP	1.4A
	2.0A
BOTTOM	3.1A

$V_{DD} = 50V$

Starting T_J, Junction Temperature(°C)

Fig 12c. Maximum Avalanche Energy Vs. Drain Current

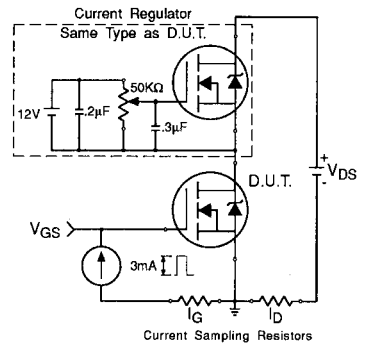**Fig 13a.** Basic Gate Charge Waveform

Fig 13b. Gate Charge Test Circuit

Appendix A: Figure 14, Peak Diode Recovery dv/dt Test Circuit – See page 1505

Appendix B: Package Outline Mechanical Drawing – See page 1510

Appendix C: Part Marking Information – See page 1517

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