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INTERNATIONAL RECTIFIER

Data Sheet No. PD-9.404A

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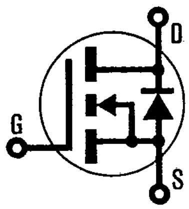
T-39-11

HEXFET® TRANSISTORS

IRFJ230 IRFJ231 IRFJ232 IRFJ233

N-CHANNEL POWER MOSFETs



200 Volt, 0.4 Ohm HEXFET

The HEXFET® technology is the key to International Rectifier's advanced line of power MOSFET transistors. The efficient geometry and unique processing of the HEXFET design achieve very low on-state resistance combined with high transconductance and great device ruggedness.

The HEXFET transistors also feature all of the well established advantages of MOSFETs such as voltage control, very fast switching, ease of paralleling, and temperature stability of the electrical parameters.

They are well suited for applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers, and high energy pulse circuits.

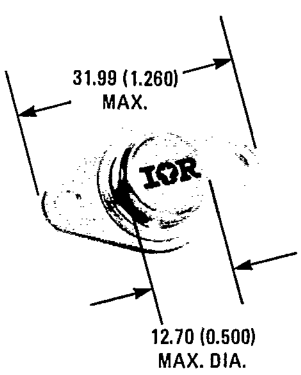
Features:

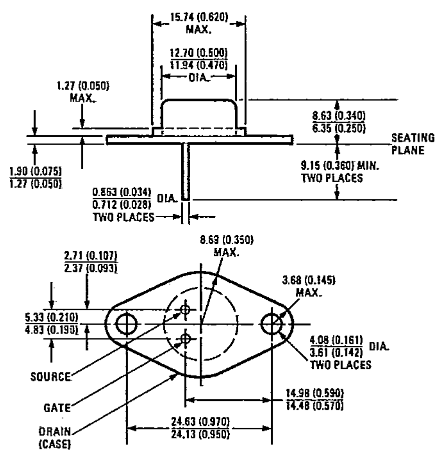
- Fast Switching
- Low Drive Current
- Ease of Paralleling
- Excellent Temperature Stability

Product Summary

Part Number	V_{DS}	$R_{DS(on)}$	I_D
IRFJ230	200V	0.4Ω	8.0A
IRFJ231	150V	0.4Ω	8.0A
IRFJ232	200V	0.6Ω	6.5A
IRFJ233	150V	0.6Ω	6.5A

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Case Style TO-213AA (TO-66)
Dimensions in Millimeters and (Inches)

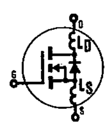
TO-66

IRFJ230, IRFJ231, IRFJ232, IRFJ233 Devices

Absolute Maximum Ratings

Parameter		IRFJ230	IRFJ231	IRFJ232	IRFJ233	Units
V_{DS}	Drain - Source Voltage ①	200	150	200	150	V
V_{DGR}	Drain - Gate Voltage (R_{GS} = 20 KΩ) ①	200	150	200	150	V
I_D @ T_C = 25°C	Continuous Drain Current	8.0	8.0	6.5	6.5	A
I_D @ T_C = 100°C	Continuous Drain Current	5.0	5.0	4.0	4.0	A
I_{DM}	Pulsed Drain Current ③	32	32	26	26	A
V_{GS}	Gate - Source Voltage	± 20				V
P_D @ T_C = 25°C	Max. Power Dissipation	50 (See Fig. 14)				W
	Linear Derating Factor	0.4 (See Fig. 14)				W/K ④
I_{LM}	Inductive Current, Clamped	(See Fig. 15 and 16) L = 100μH 32	32	26	26	A
T_J T_{stg}	Operating Junction and Storage Temperature Range	-55 to 150				°C
	Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				°C

Electrical Characteristics @T_C = 25°C (Unless Otherwise Specified)

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS}	Drain - Source Breakdown Voltage	IRFJ230 IRFJ232	200	–	–	V	V_{GS} = 0V
		IRFJ231 IRFJ233	150	–	–	V	I_D = 250μA
$V_{GS(th)}$	Gate Threshold Voltage	ALL	2.0	–	4.0	V	V_{DS} = V_{GS}, I_D = 250μA
I_{GSS}	Gate - Source Leakage Forward	ALL	–	–	100	nA	V_{GS} = 20V
I_{GSS}	Gate - Source Leakage Reverse	ALL	–	–	-100	nA	V_{GS} = -20V
I_{DSS}	Zero Gate Voltage Drain Current	ALL	–	–	250	μA	V_{DS} = Max. Rating, V_{GS} = 0V
			–	–	1000	μA	V_{DS} = Max. Rating x 0.8, V_{GS} = 0V, T_C = 125°C
$I_{D(on)}$	On-State Drain Current ②	IRFJ230 IRFJ231	8.0	–	–	A	V_{DS} > $I_{D(on)}$ x $R_{DS(on)max.}$, V_{GS} = 10V
		IRFJ232 IRFJ233	6.5	–	–	A	
$R_{DS(on)}$	Static Drain-Source On-State Resistance ②	IRFJ230 IRFJ231	–	0.25	0.4	Ω	V_{GS} = 10V, I_D = 4.0A
		IRFJ232 IRFJ233	–	0.4	0.6	Ω	
g_{fs}	Forward Transconductance ②	ALL	3.0	4.8	–	S (℧)	V_{DS} > $I_{D(on)}$ x $R_{DS(on)max.}$, I_D = 4.0A
C_{iss}	Input Capacitance	ALL	–	600	800	pF	V_{GS} = 0V, V_{DS} = 25V, f = 1.0 MHz See Fig. 10
C_{oss}	Output Capacitance	ALL	–	250	450	pF	
C_{rss}	Reverse Transfer Capacitance	ALL	–	80	150	pF	
$t_{d(on)}$	Turn-On Delay Time	ALL	–	–	30	ns	V_{DD} = 90V, I_D = 4.0A, Z_o = 15Ω See Fig. 17 (MOSFET switching times are essentially independent of operating temperature.)
t_r	Rise Time	ALL	–	–	50	ns	
$t_{d(off)}$	Turn-Off Delay Time	ALL	–	–	50	ns	
t_f	Fall Time	ALL	–	–	40	ns	
Q_g	Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	–	19	30	nC	V_{GS} = 10V, I_D = 10A, V_{DS} = 0.8 Max. Rating. See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)
Q_{gs}	Gate-Source Charge	ALL	–	10	–	nC	
Q_{gd}	Gate-Drain ("Miller") Charge	ALL	–	9.0	–	nC	
L_D	Internal Drain Inductance	ALL	–	5.0	–	nH	Measured between the contact screw on header that is closer to source and gate pins and center of die. Modified MOSFET symbol showing the internal device inductances. 
L_S	Internal Source Inductance	ALL	–	12.5	–	nH	Measured from the source pin, 6 mm (0.25 in.) from header and source bonding pad.

Thermal Resistance

R_{thJC}	Junction-to-Case	ALL	–	–	2.5	K/W ④	
R_{thCS}	Case-to-Sink	ALL	–	0.2	–	K/W ④	Mounting surface flat, smooth, and greased.
R_{thJA}	Junction-to-Ambient	ALL	–	–	50	K/W ④	Typical socket mount

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Source-Drain Diode Ratings and Characteristics

I_S	Continuous Source Current (Body Diode)	IRFJ230 IRFJ231	—	—	8.0	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
		IRFJ232 IRFJ233	—	—	6.5	A	
I_{SM}	Pulse Source Current (Body Diode) ③	IRFJ230 IRFJ231	—	—	32	A	
		IRFJ232 IRFJ233	—	—	26	A	
V_{SD}	Diode Forward Voltage ②	IRFJ230 IRFJ231	—	—	2.0	V	$T_C = 25°C, I_S = 8.0A, V_{GS} = 0V$
		IRFJ232 IRFJ233	—	—	1.8	V	$T_C = 25°C, I_S = 6.5A, V_{GS} = 0V$
t_{rr}	Reverse Recovery Time	ALL	—	450	—	ns	$T_J = 150°C, I_F = 8.0A, dI_F/dt = 100A/\mu s$
Q_{RR}	Reverse Recovered Charge	ALL	—	3.0	—	μC	$T_J = 150°C, I_F = 8.0A, dI_F/dt = 100A/\mu s$
t_{on}	Forward Turn-on Time	ALL	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by $L_S + L_D$.				

① $T_J = 25°C$ to $150°C$. ② Pulse Test: Pulse width ≤ 300µs, Duty Cycle ≤ 2%. ③ Repetitive Rating: Pulse width limited by max. junction temperature. See Transient Thermal Impedance Curve (Fig. 5).

④ K/W = °C/W
W/K = W/°C

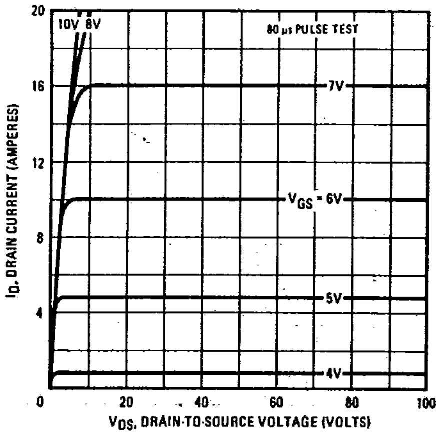

Fig. 1 — Typical Output Characteristics

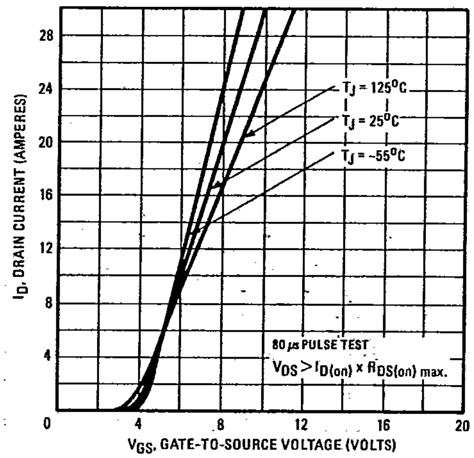

Fig. 2 — Typical Transfer Characteristics

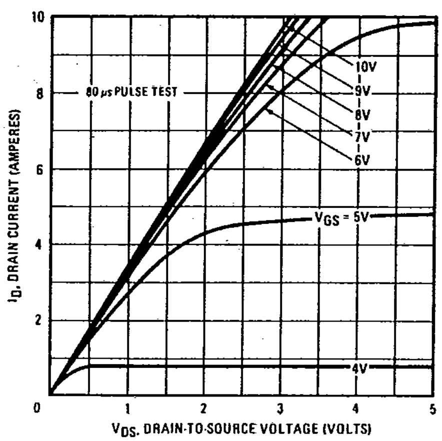

Fig. 3 — Typical Saturation Characteristics

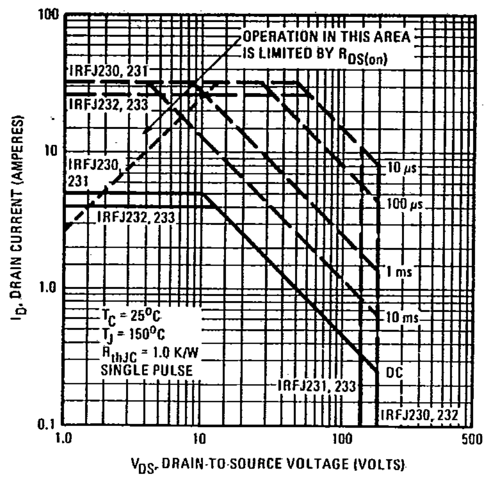

Fig. 4 — Maximum Safe Operating Area

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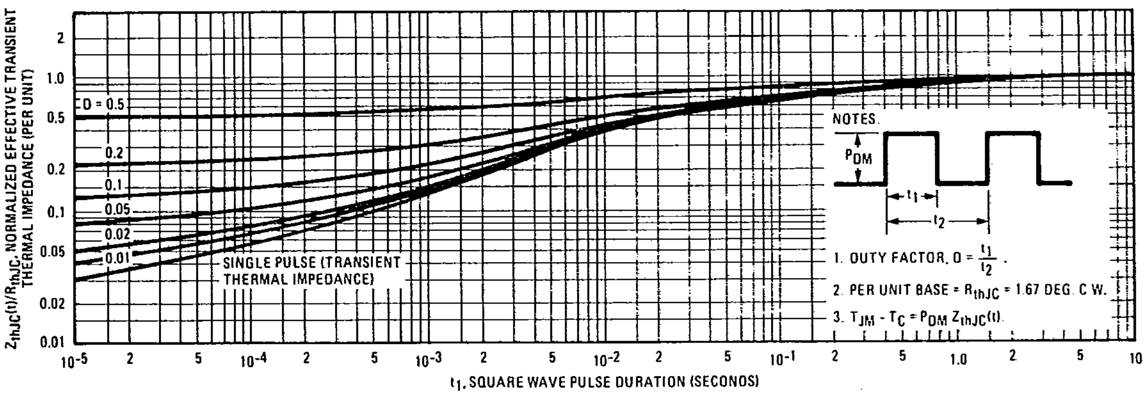

Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

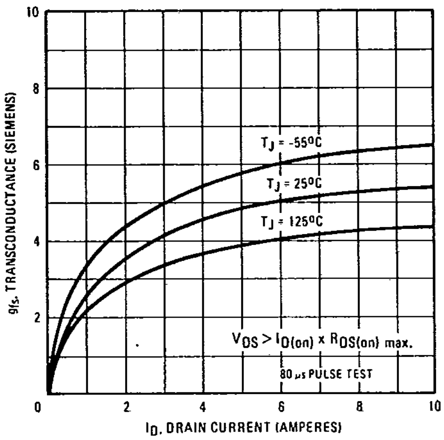

Fig. 6 — Typical Transconductance Vs. Drain Current

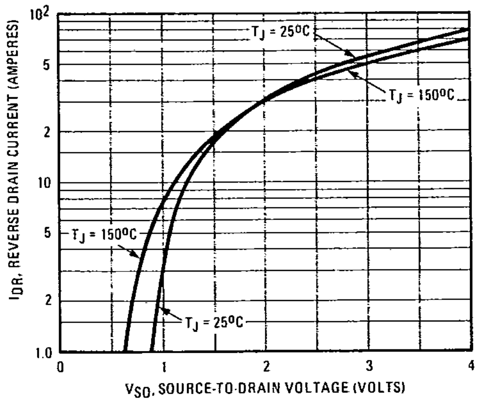

Fig. 7 — Typical Source-Drain Diode Forward Voltage

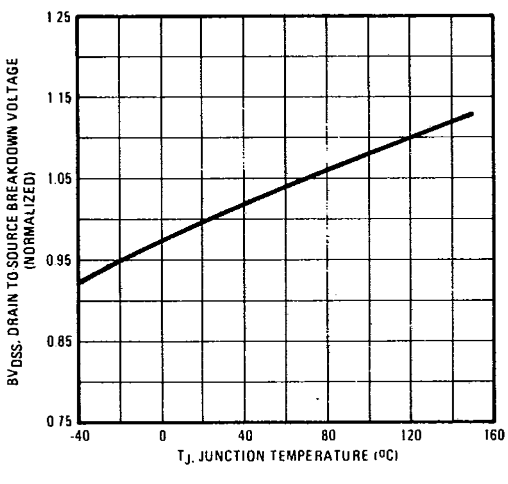

Fig. 8 — Breakdown Voltage Vs. Temperature

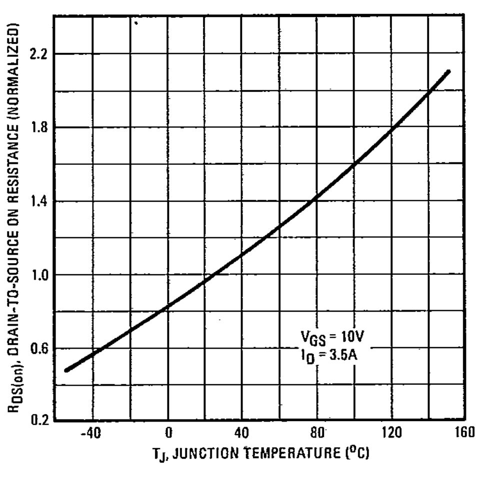

Fig. 9 — Normalized On-Resistance Vs. Temperature

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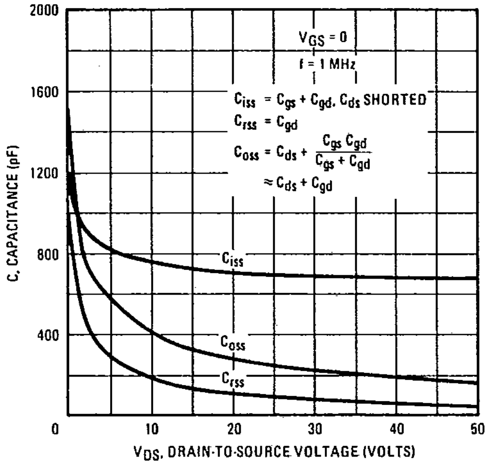

Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

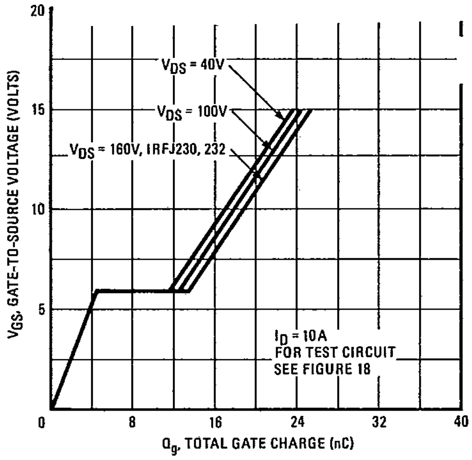

Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

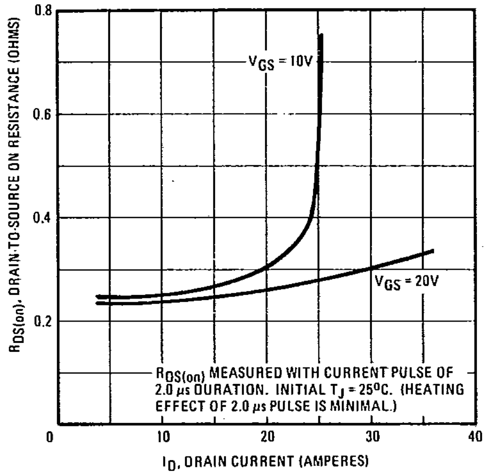

Fig. 12 — Typical On-Resistance Vs. Drain Current

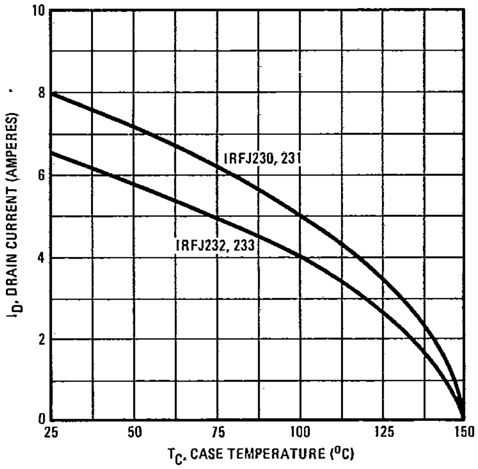

Fig. 13 — Maximum Drain Current Vs. Case Temperature

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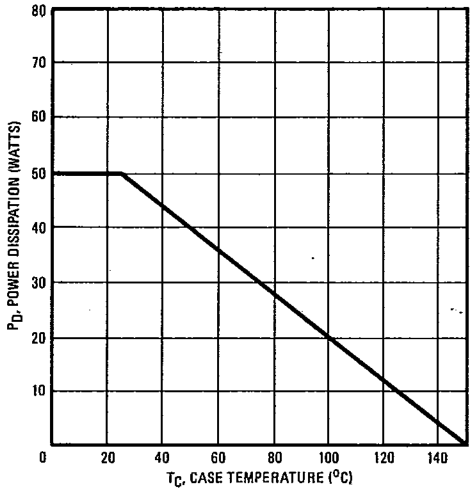

Fig. 14 — Power Vs. Temperature Derating Curve

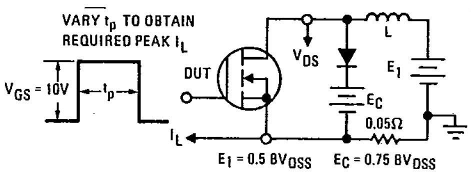

Fig. 15 — Clamped Inductive Test Circuit

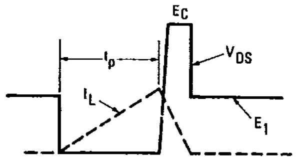

Fig. 16 — Clamped Inductive Waveforms

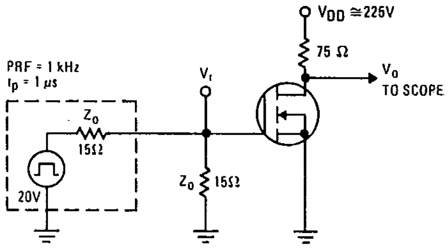

Fig. 17 — Switching Time Test Circuit

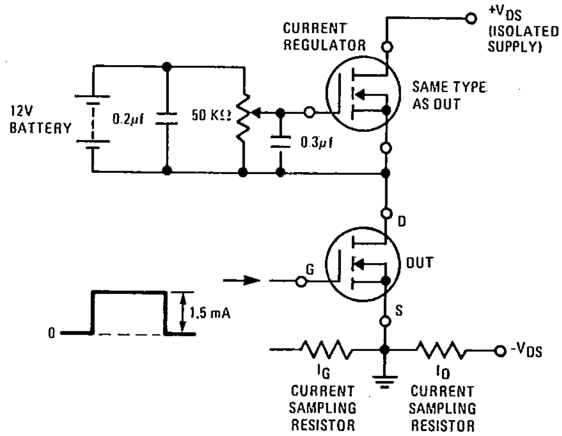

Fig. 18 — Gate Charge Test Circuit