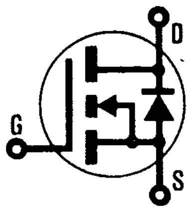
Data Sheet No. PD-9.473A

INTERNATIONAL RECTIFIER IOR

HEXFET® TRANSISTORS IRF224 IRF225



N-CHANNEL

250 Volt, 1.1 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 motor controls, inverters, choppers and audio amplifiers. The voltage rating makes them cost effective for the 115 volt offline switching applications like battery chargers, hand drills, lighting ballasts, washing machines and dryers.

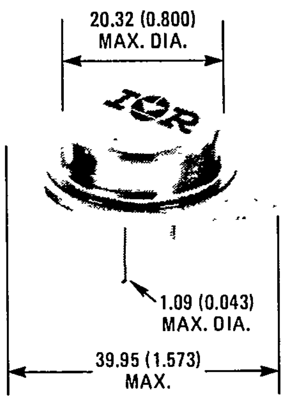
Features

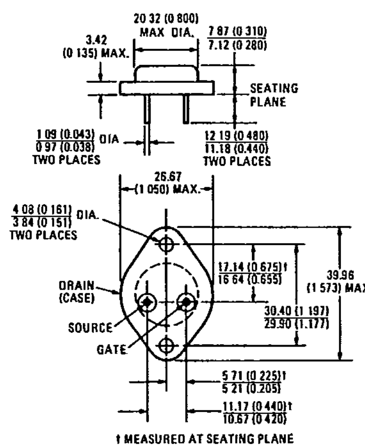
- Fast Switching
- Low Drive Current
- Low $R_{DS(on)}$
- High Reverse Energy
- Excellent Temperature Stability
- Ease of Paralleling

Product Summary

Part Number	V_{DS}	$R_{DS(on)}$	I_D
IRF224	250V	1.1Ω	3.8A
IRF225	250V	1.5Ω	3.3A

CASE STYLE AND DIMENSIONS





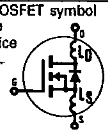
Conforms to JEDEC Outline TO-204AA (TO-3)
Dimensions in Millimeters and (Inches)

TO-3

Absolute Maximum Ratings

Parameter		IRF224	IRF225	Units
V_{DS}	Drain - Source Voltage ①	250	250	V
V_{DGR}	Drain - Gate Voltage (R_{GS} = 20 KΩ) ①	250	250	V
I_D @ T_C = 25°C	Continuous Drain Current	3.8	3.3	A
I_D @ T_C = 100°C	Continuous Drain Current	2.4	2.1	A
I_{DM}	Pulsed Drain Current ②	15	13	A
V_{GS}	Gate — Source Voltage	±20		V
P_D @ T_C = 25°C	Max. Power Dissipation	40		W
	Linear Derating Factor	0.32		W/K ⑤
I_{LM}	Inductive Current, Clamped	(See Fig. 14) L = 100μH 15	13	A
I_L	Unclamped Inductive Current (Avalanche Current)③	(See Fig. 15) 2.2		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 Noted

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS}	Drain - Source Breakdown Voltage	IRF224	250	—	—	V	V_{GS} = 0V
		IRF225					I_D = 250 μA
$V_{GS(th)}$	Gate Threshold Voltage	ALL	2.0	—	4.0	V	V_{DS} = V_{GS}, I_D = 250 μA
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 × 0.8, V_{GS} = 0V, T_C = 125°C
$I_{D(on)}$	On-State Drain Current ④	IRF224	3.8	—	—	A	V_{DS} > $I_{D(on)}$ × $R_{DS(on)max.}$, V_{GS} = 10V
		IRF225	3.3	—	—	A	
$R_{DS(on)}$	Static Drain-Source On-State Resistance ④	IRF224	—	0.79	1.1	Ω	V_{GS} = 10V, I_D = 2.1A
		IRF225	—	1.1	1.5	Ω	
g_{fs}	Forward Transconductance ④	ALL	1.4	2.1	—	S(Ω)	V_{DS} = 2×V_{GS}, I_{DS} = 1.9A
C_{iss}	Input Capacitance	ALL	—	340	—	pF	V_{GS} = 0V, V_{DS} = 25V, f = 1.0 MHz
C_{oss}	Output Capacitance	ALL	—	110	—	pF	See Fig. 10
C_{rss}	Reverse Transfer Capacitance	ALL	—	32	—	pF	
$t_{d(on)}$	Turn-On Delay Time	ALL	—	11	17	ns	V_{DD} = 125V, I_D ≈ 3.8A, R_G = 18Ω, R_D = 32Ω
t_r	Rise Time	ALL	—	24	36	ns	See Fig. 16
$t_{d(off)}$	Turn-Off Delay Time	ALL	—	21	32	ns	(MOSFET switching times are essentially independent of
t_f	Fall Time	ALL	—	13	20	ns	operating temperature.)
Q_g	Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	16	22	nC	V_{GS} = 10V, I_D = 3.8A, V_{DS} = 0.8 Max. Rating. See Fig. 17 for test circuit. (Gate charge is essentially
Q_{gs}	Gate-Source Charge	ALL	—	4.0	6.0	nC	independent of operating temperature.)
Q_{gd}	Gate-Drain ("Miller") Charge	ALL	—	7.2	11	nC	
L_D	Internal Drain Inductance	ALL	—	5.0	—	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die. — Modified MOSFET symbol showing the internal device inductances. 
L_S	Internal Source Inductance	ALL	—	13	—	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad.

Thermal Resistance

R_{thJC}	Junction-to-Case	ALL	—	—	3.12	K/W ⑤	
R_{thCS}	Case-to-Sink	ALL	—	0.15	—	K/W ⑤	Mounting surface flat, smooth, and greased.
R_{thJA}	Junction-to-Ambient	ALL	—	—	30	K/W ⑤	Typical socket mount

Source-Drain Diode Ratings and Characteristics

I_S	Continuous Source Current (Body Diode)	IRF224	—	—	3.8	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
		IRF225	—	—	3.3	A	
I_{SM}	Pulse Source Current (Body Diode) ③	IRF224	—	—	15	A	
		IRF225	—	—	13	A	
V_{SD}	Diode Forward Voltage ②	ALL	—	—	1.8	V	$T_C = 25°C$, $I_S = 3.8A$, $V_{GS} = 0V$
t_{rr}	Reverse Recovery Time	ALL	81	180	370	ns	$T_J = 25°C$, $I_F = 3.8A$, $dI_F/dt = 100A/\mu s$
Q_{RR}	Reverse Recovered Charge	ALL	0.44	0.93	2.0	μC	$T_J = 25°C$, $I_F = 3.8A$, $dI_F/dt = 100A/\mu s$
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 Repetitive Rating: Pulse width limited by max. junction temperature. See Transient Thermal Response Curve (Fig. 5)

③ $V_{dd} = 50$ V Starting $T_j = 25°C$, $L = 100\ \mu H$ $R_G = 25\Omega$

④ Pulse Test: Pulse width ≤ 300 μs Duty Cycle ≤ 2%.

⑤ K/W = °C/W, W/K = W/°C

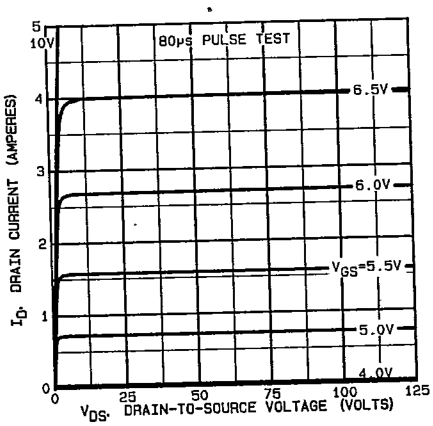


Fig. 1 — Typical Output Characteristics

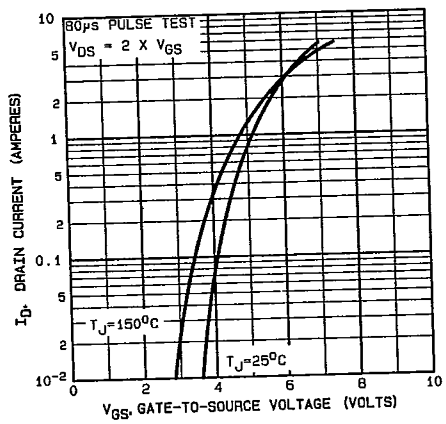


Fig. 2 — Typical Transfer Characteristics

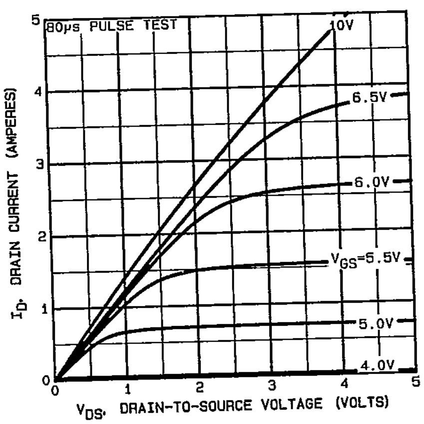


Fig. 3 — Typical Saturation Characteristics

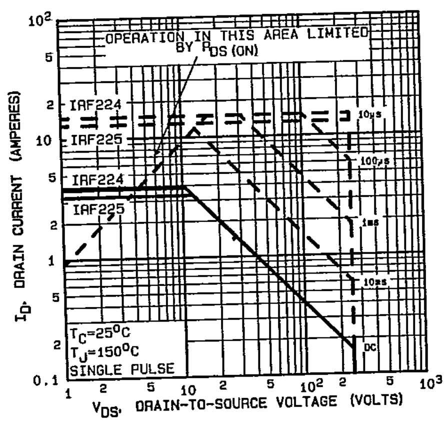


Fig. 4 — Maximum Safe Operating Area

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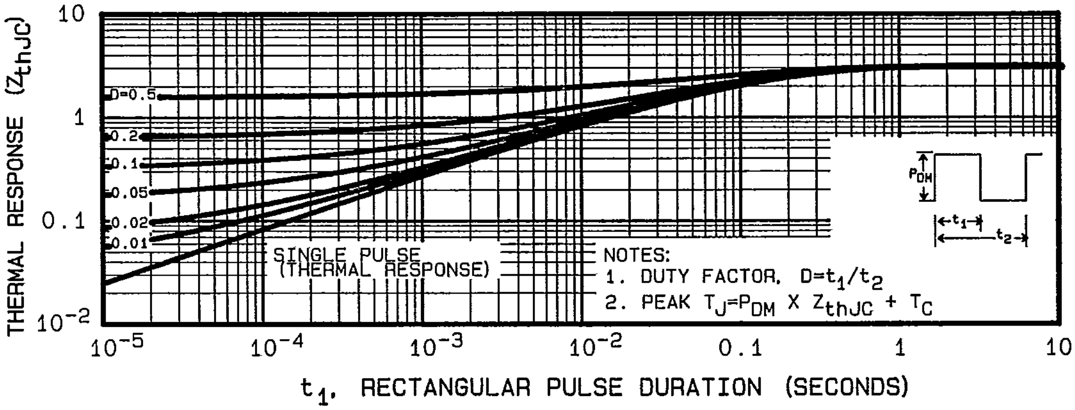

Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

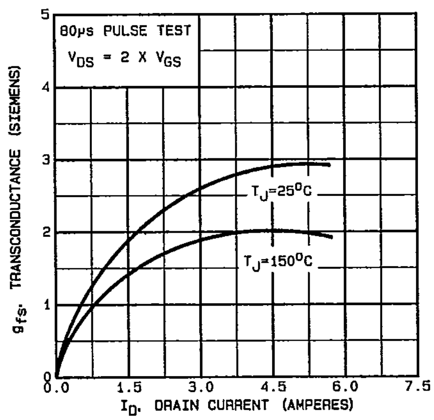

Fig. 6 — Typical Transconductance Vs. Drain Current

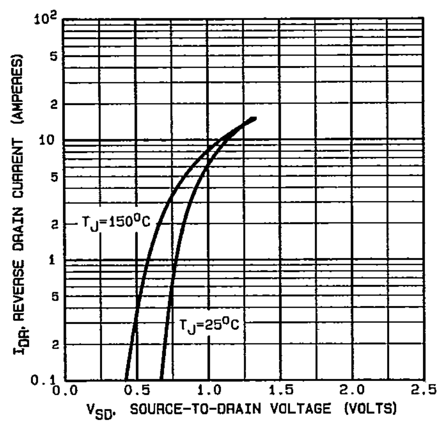

Fig. 7 — Typical Source-Drain Diode Forward Voltage

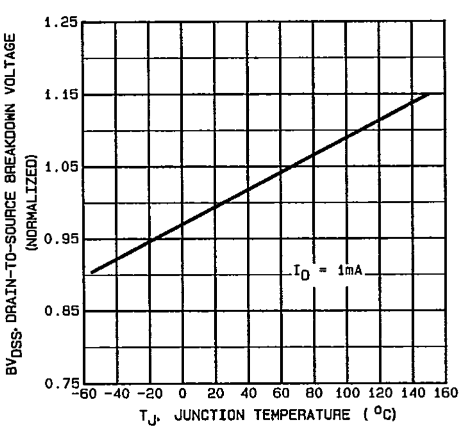

Fig. 8 — Breakdown Voltage Vs. Temperature

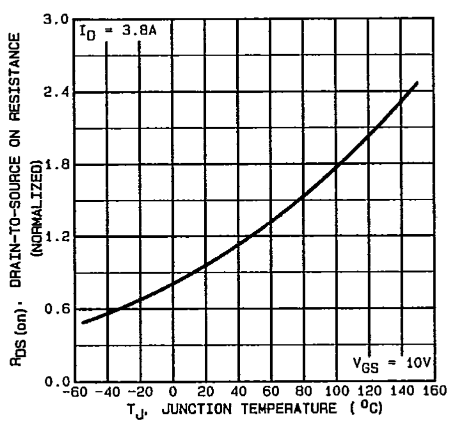

Fig. 9 — Normalized On-Resistance Vs. Temperature

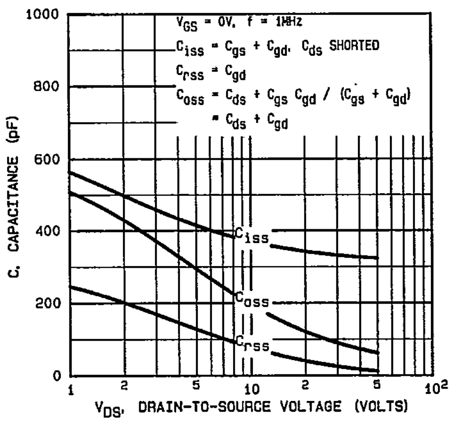

Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

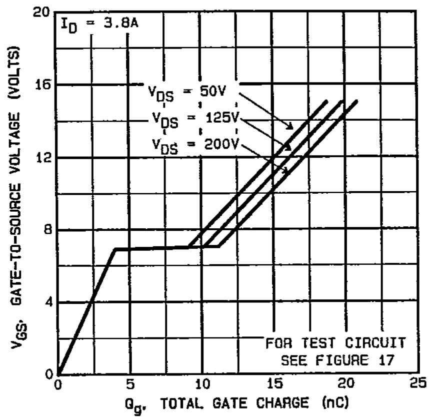

Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

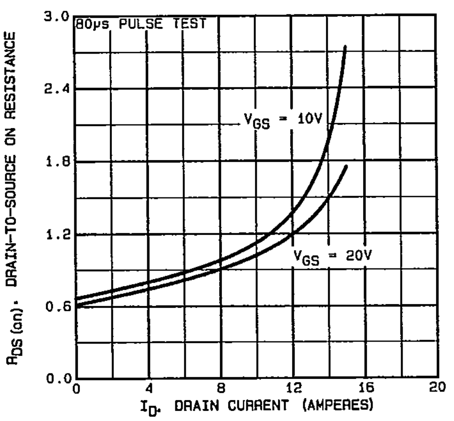

Fig. 12 — Typical On-Resistance Vs. Drain Current

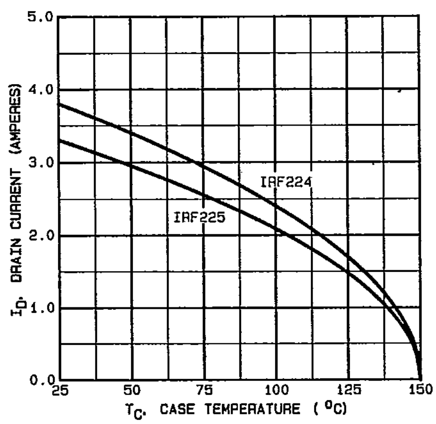

Fig. 13 — Maximum Drain Current Vs. Case Temperature

TO-3

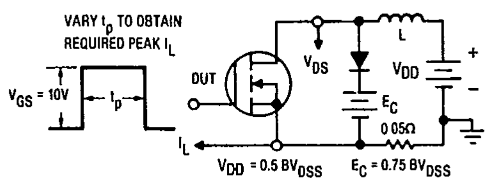

Fig. 14a — Clamped Inductive Test Circuit

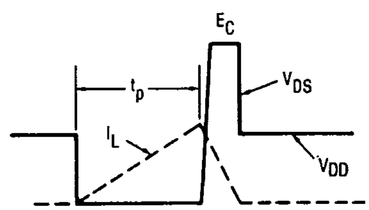

Fig. 14b — Clamped Inductive Waveforms

IRF224, IRF225 Devices

T-39-11

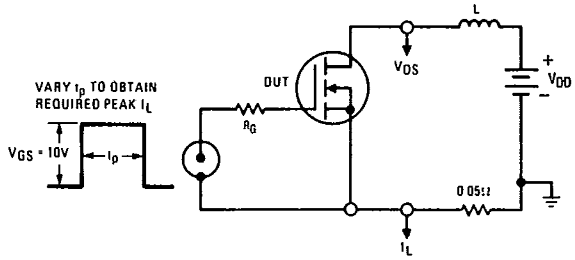

Fig. 15a — Unclamped Inductive Test Circuit

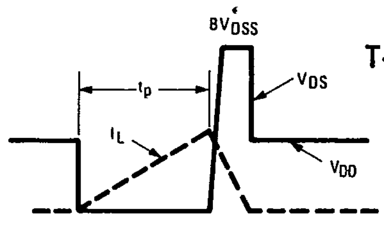

Fig. 15b — Unclamped Inductive Load Test Waveforms

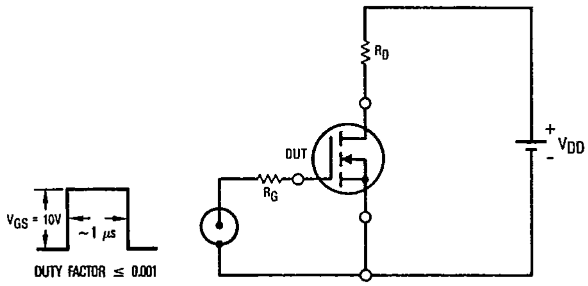

Fig. 16 — Switching Time Test Circuit

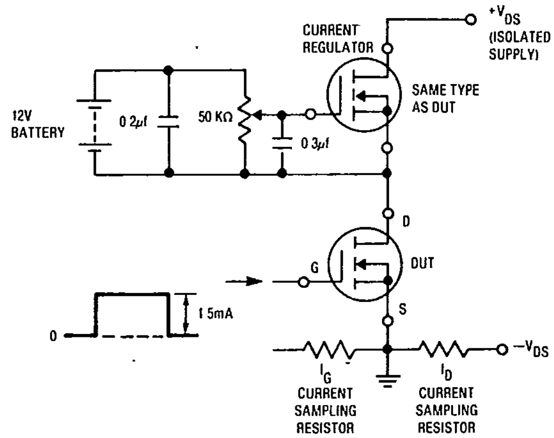

Fig. 17 — Gate Charge Test Circuit

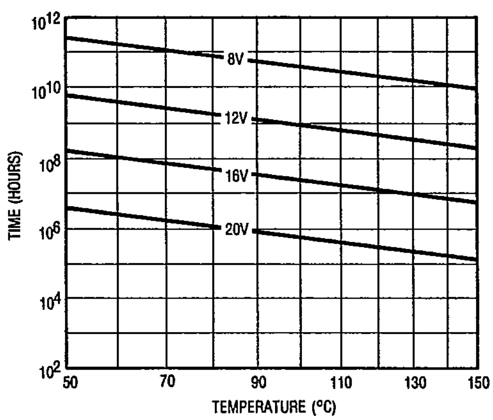

*Fig. 18 — Typical Time to Accumulated 1% Gate Failure

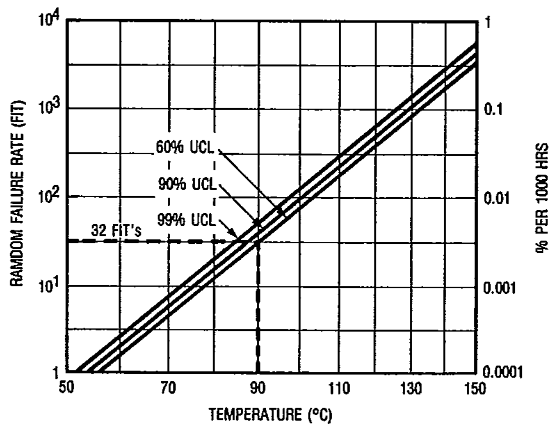

*Fig. 19 — Typical High Temperature Reverse Bias (HTRB) Failure Rate

*The data shown is correct as of April 15, 1987. This information is updated on a quarterly basis; for the latest reliability data, please contact your local IR field office.