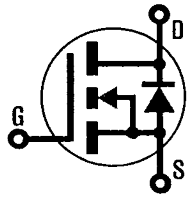
Data Sheet No. PD-9.435A

T-39-13

INTERNATIONAL RECTIFIER IOR

HEXFET® TRANSISTORS IRFZ40 IRFZ42

N-Channel 50 VOLT POWER MOSFETs



TO-220

50 Volt, 0.028 Ohm HEXFET TO-220AB Plastic Package

The HEXFET technology has expanded its product base to serve the low voltage, very low $R_{DS(on)}$ MOSFET transistor requirements. International Rectifier's highly efficient geometry and unique processing of the HEXFET have been combined to create the lowest on resistance per device performance. In addition to this feature all HEXFETs have documented reliability and parts per million quality !

The HEXFET transistors also offer 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, high energy pulse circuits, and in systems that are operated from low voltage batteries, such as automotive, portable equipment, etc.

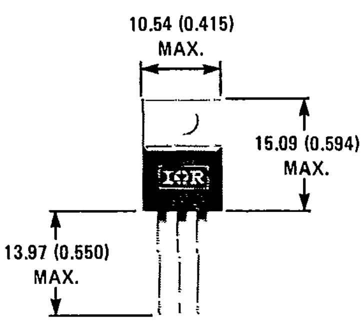
Product Summary

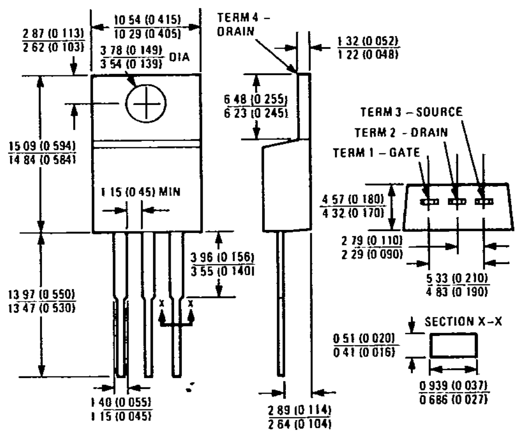
PART NUMBER	V_{DS}	$R_{DS(ON)}$	I_D
IRFZ40	50V	0.028Ω	35A*
IRFZ42	50V	0.035Ω	35A*

Features:

- Extremely Low $R_{DS(on)}$
- Compact Plastic Package
- Fast Switching
- Low Drive Current
- Ease of Paralleling
- Excellent Temperature Stability
- Parts Per Million Quality

CASE STYLE AND DIMENSIONS





Case Style TO-220AB
Dimensions in Millimeters and (Inches)

*I_D Current limited by pin diameter

IRFZ40, IRFZ42 Series

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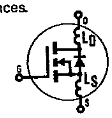
Absolute Maximum Ratings

	Parameter	IRFZ40	IRFZ42	Units
V_{DS}	Drain - Source Voltage ①	50	50	V
V_{DGR}	Drain - Gate Voltage (R_{GS} = 20 KΩ) ①	50	50	V
I_D @ T_C = 25°C	Continuous Drain Current ④	35	35	A
I_D @ T_C = 100°C	Continuous Drain Current	32	29	A
I_{DM}	Pulsed Drain Current ③	160	145	A
V_{GS}	Gate - Source Voltage	±20		V
P_D @ T_C = 25°C	Max. Power Dissipation	125 (See Fig. 14)		W
	Linear Derating Factor	1.0 (See Fig. 14)		W/K⑤
I_{LM}	Inductive Current, Clamped	(See Fig. 15 and 16) L = 100μH 160	145	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	IRFZ40	50	—	—	V	V_{GS} = 0V
		IRFZ42	50	—	—	V	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	—	—	500	nA	V_{GS} = 20V
I_{GSS}	Gate-Source Leakage Reverse	ALL	—	—	−500	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 ②④	IRFZ40	35	—	—	A	$V_{DS} > I_{D(on)} \times R_{DS(on)max.}$, V_{GS} = 10V
		IRFZ42	35	—	—	A	
$R_{DS(on)}$	Static Drain-Source On-State Resistance ②	IRFZ40	—	0.024	0.028	Ω	V_{GS} = 10V, I_D = 29A
		IRFZ42	—	0.030	0.035	Ω	
g_{fs}	Forward Transconductance ②	ALL	17	22	—	S(Ω)	$V_{DS} > I_{D(on)} \times R_{DS(on)\ max.}$, I_D = 29A
C_{iss}	Input Capacitance	ALL	—	2350	3000	pF	V_{GS} = 0V, V_{DS} = 25V, f = 1.0 MHz
C_{oss}	Output Capacitance	ALL	—	920	1200	pF	See Fig. 10
C_{rss}	Reverse Transfer Capacitance	ALL	—	250	400	pF	
$t_{d(on)}$	Turn-On Delay Time	ALL	—	18	25	ns	V_{DD} ≅ 25V, I_D = 29A, Z_o = 4.7Ω
t_r	Rise Time	ALL	—	25	60	ns	See Fig. 17
$t_{d(off)}$	Turn-Off Delay Time	ALL	—	35	70	ns	(MOSFET switching times are essentially independent of
t_f	Fall Time	ALL	—	12	25	ns	operating temperature.)
Q_g	Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	40	60	nC	V_{GS} = 10V, I_D = 64A, 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	—	22	—	nC	
Q_{gd}	Gate-Drain ("Miller") Charge	ALL	—	18	—	nC	
L_D	Internal Drain Inductance	ALL	—	3.5	—	nH	Measured from the contact screw on tab to center of die. — Modified MOSFET symbol showing the internal device inductances. 
			—	4.5	—	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die.
L_S	Internal Source Inductance	ALL	—	7.5	—	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad.

Thermal Resistance

R_{thJC}	Junction-to-Case	ALL	—	—	1.0	W/K⑤	
R_{thCS}	Case-to-Sink	ALL	—	1.0	—	W/K⑤	Mounting surface flat, smooth, and greased.
R_{thJA}	Junction-to-Ambient	ALL	—	—	80	W/K⑤	Typical socket mount

IRFZ40, IRFZ42 Series

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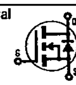
Source-Drain Diode Ratings and Characteristics

I_S	Continuous Source Current (Body Diode)	IRFZ40	—	—	35	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier. 
		IRFZ42	—	—	35	A	
I_{SM}	Pulse Source Current (Body Diode) ③	IRFZ40	—	—	160	A	
		IRFZ42	—	—	145	A	
V_{SD}	Diode Forward Voltage ②	IRFZ40	—	—	2.5	V	$T_C = 25°C$, $I_S = 51A$, $V_{GS} = 0V$
		IRFZ42	—	—	2.2	V	$T_C = 25°C$, $I_S = 46A$, $V_{GS} = 0V$
t_{rr}	Reverse Recovery Time	ALL	—	350	—	ns	$T_J = 150°C$, $I_F = 51A$, $dI_F/dt = 100A/\mu s$
Q_{RR}	Reverse Recovered Charge	ALL	—	2.1	—	μC	$T_J = 150°C$, $I_F = 51A$, $dI_F/dt = 100A/\mu s$
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 $\leq 300\mu s$, Duty Cycle $\leq 2\%$. ③ Repetitive Rating: Pulse width limited by max. junction temperature. See Transient Thermal Impedance Curve (Fig. 5).

④ I_D Current limited by pin diameter. ⑤ K/W = °C/W W/K = W/°C

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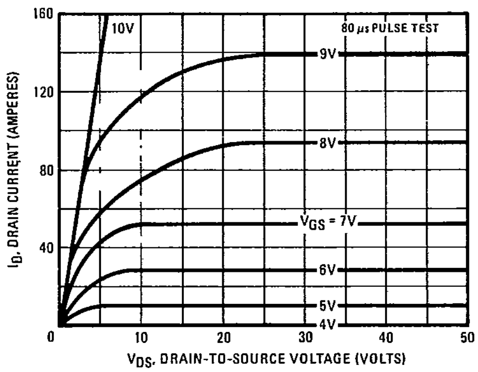

Fig. 1 — Typical Output Characteristics

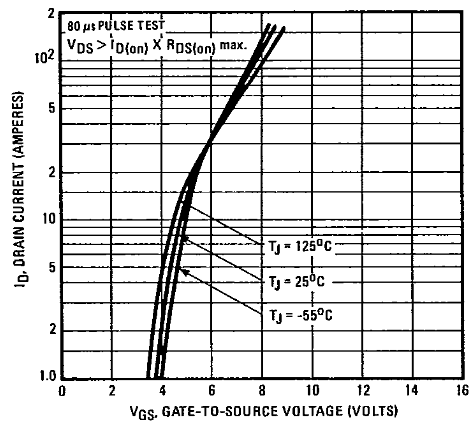

Fig. 2 — Typical Transfer Characteristics

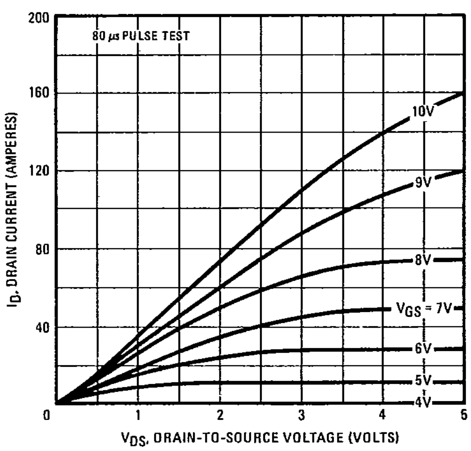

Fig. 3 — Typical Saturation Characteristics

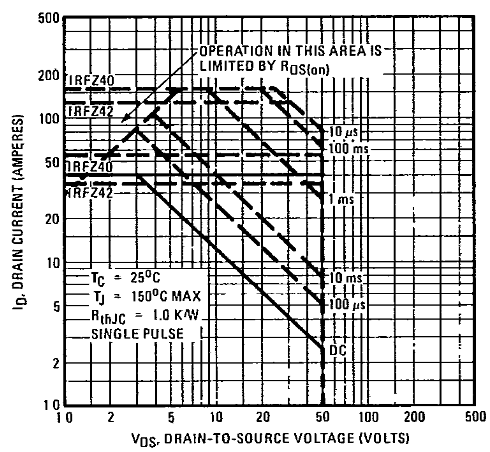

Fig. 4 — Maximum Safe Operating Area

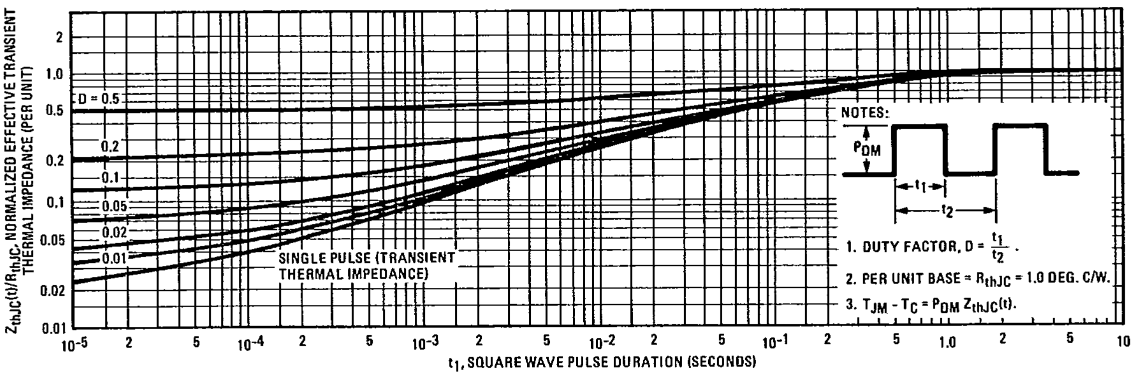

Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-toCase Vs. Pulse Duration

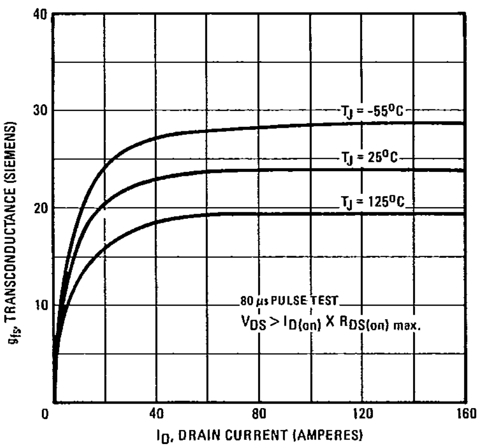

Fig. 6 — Typical Transconductance Vs. Drain Current

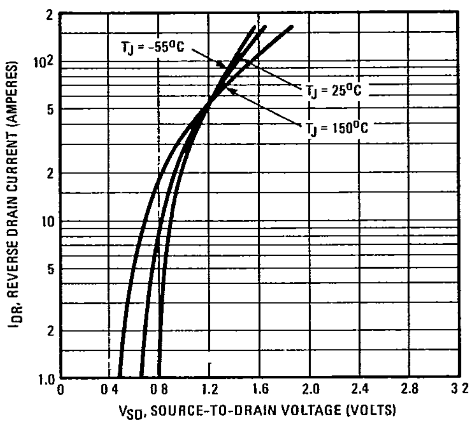

Fig. 7 — Typical Source-Drain Diode Forward Voltage

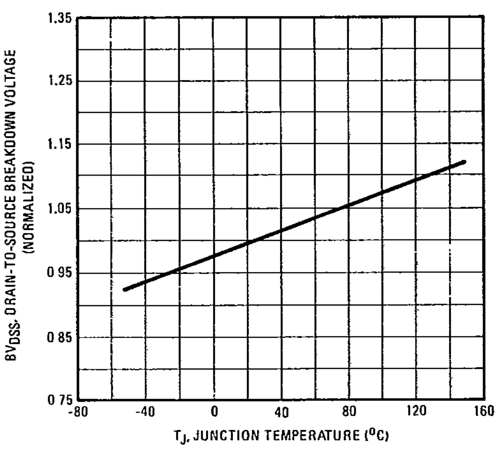

Fig. 8 — Breakdown Voltage Vs. Temperature

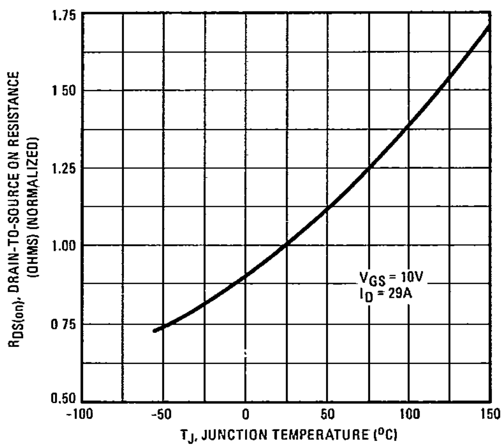

Fig. 9 — Normalized On-Resistance Vs. Temperature

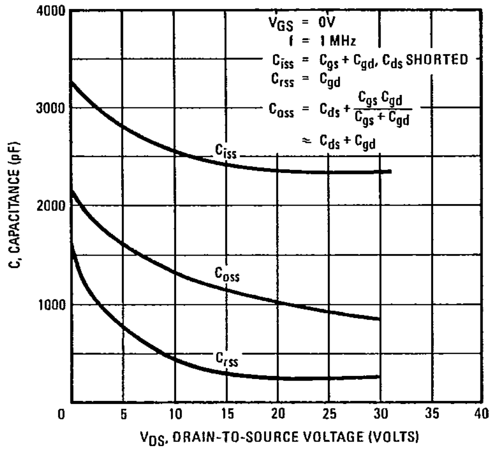

Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

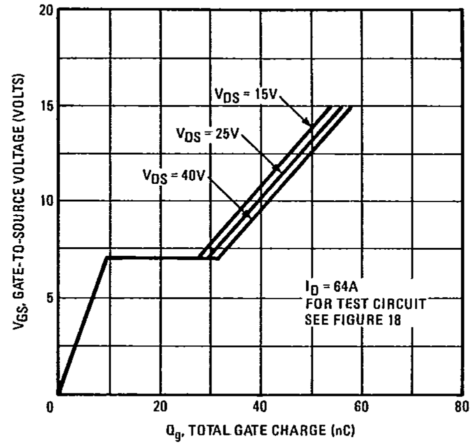

Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

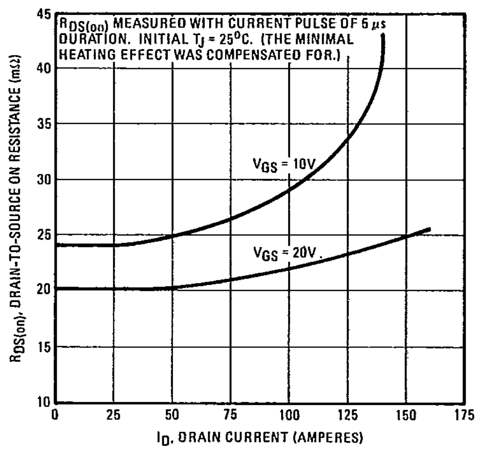

Fig. 12 — Typical On-Resistance Vs. Drain Current

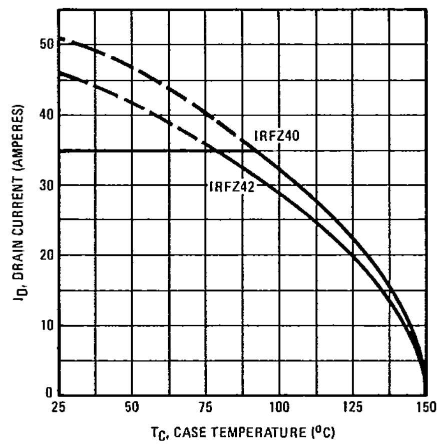

Fig. 13 — Maximum Drain Current Vs. Case Temperature

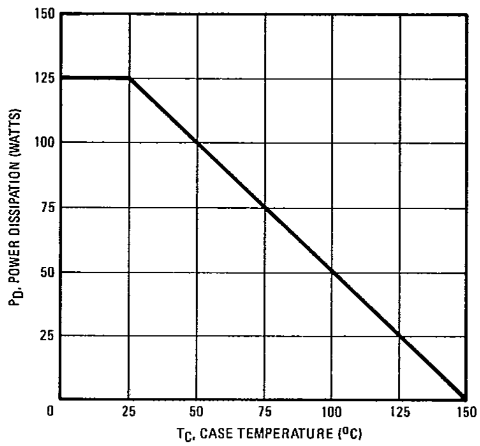

Fig. 14 — Power Vs. Temperature Derating Curve

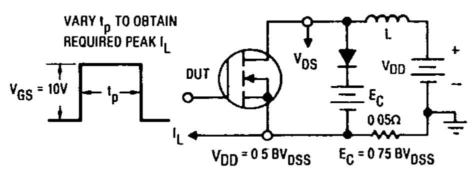

Fig. 15 — Clamped Inductive Test Circuit

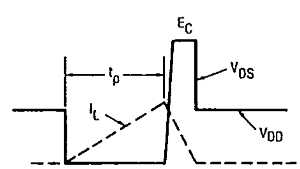

Fig. 16 — Clamped Inductive Waveforms

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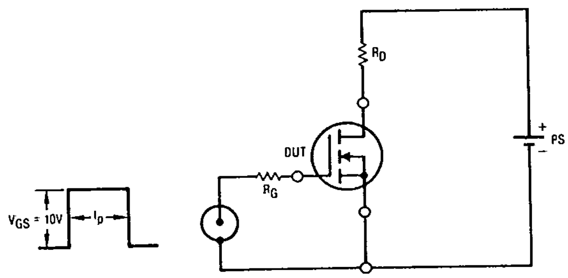

Fig. 17 — Switching Time Test Circuit

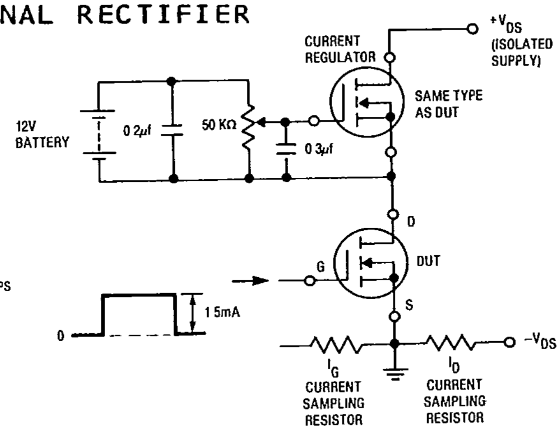

Fig. 18 — Gate Charge Test Circuit

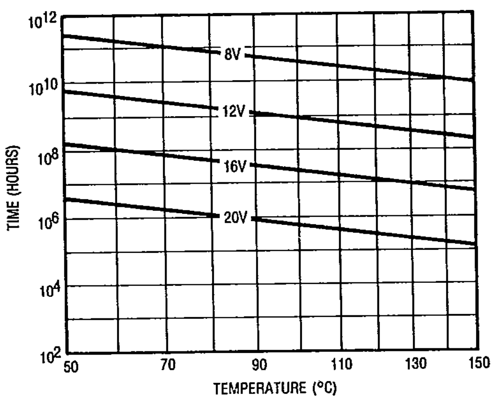

*Fig. 19 — Typical Time to Accumulated 1% Failure

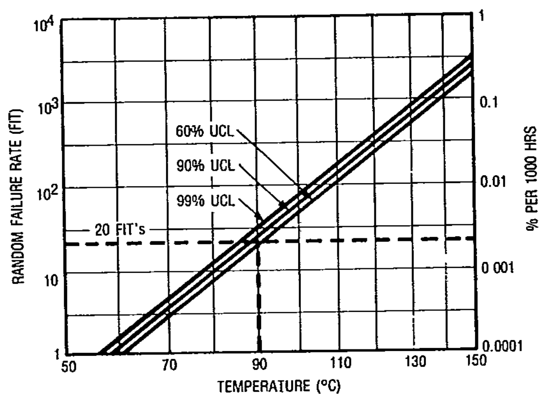

*Fig. 20 — Typical High Temperature Reverse Bias (HTRB) Failure Rate

*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.