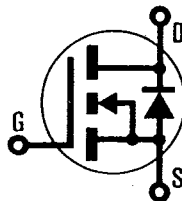


INTERNATIONAL RECTIFIER

T-39-11

INTERNATIONAL RECTIFIER **IR****HEXFET® TRANSISTORS IRFJ440****N-CHANNEL
POWER MOSFETs****IRFJ441****IRFJ442****IRFJ443****500 Volt, 0.85 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.

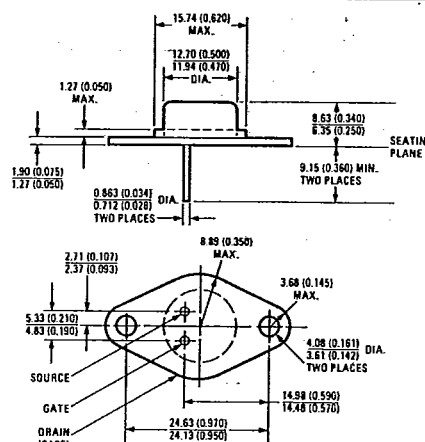
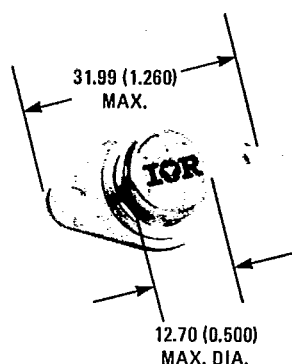
They are well suited for applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers, and high energy pulse circuits.

Features:

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

Product Summary

Part Number	V _{DS}	R _{DS(on)}	I _D
IRFJ440	500V	0.85Ω	6.0A
IRFJ441	450V	0.85Ω	6.0A
IRFJ442	500V	1.10Ω	5.0A
IRFJ443	450V	1.10Ω	5.0A

CASE STYLE AND DIMENSIONS

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

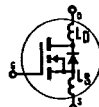
TO-66

Absolute Maximum Ratings

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Parameter	IRFJ440	IRFJ441	IRFJ442	IRFJ443	Units
V_{DS} Drain - Source Voltage ①	500	450	500	450	V
V_{DGR} Drain - Gate Voltage ($R_{GS} = 20\text{ K}\Omega$) ①	500	450	500	450	V
$I_D @ T_C = 25^\circ\text{C}$ Continuous Drain Current	6.0	6.0	5.0	5.0	A
$I_D @ T_C = 100^\circ\text{C}$ Continuous Drain Current	4.0	4.0	3.0	3.0	A
I_{DM} Pulsed Drain Current ③	24	24	20	20	A
V_{GS} Gate - Source Voltage	± 20				V
$P_D @ T_C = 25^\circ\text{C}$ Max. Power Dissipation	70 (See Fig. 14)				W
Linear Derating Factor	0.55 (See Fig. 14)				W/K ④
I_{LM} Inductive Current, Clamped	(See Fig. 15 and 16) $L = 100\mu\text{H}$				A
T_J Operating Junction and T_{stg} Storage Temperature Range	-55 to 150				$^\circ\text{C}$
Lead Temperature	300 (0.063 in., (1.6mm) from case for 10s)				$^\circ\text{C}$

Electrical Characteristics @ $T_C = 25^\circ\text{C}$ (Unless Otherwise Specified)

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS} Drain - Source Breakdown Voltage	IRFJ440	500	—	—	V	$V_{GS} = 0\text{V}$ $I_D = 250\mu\text{A}$
	IRFJ442	—	—	—	V	
	IRFJ441 IRFJ443	450	—	—	V	
$V_{GS(th)}$ Gate Threshold Voltage	ALL	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
I_{GSS} Gate - Source Leakage Forward	ALL	—	—	100	nA	$V_{GS} = 20\text{V}$
I_{GSS} Gate - Source Leakage Reverse	ALL	—	—	-100	nA	$V_{GS} = -20\text{V}$
I_{DSS} Zero Gate Voltage Drain Current	ALL	—	—	250	μA	$V_{DS} = \text{Max. Rating}, V_{GS} = 0\text{V}$
		—	—	1000	μA	$V_{DS} = \text{Max. Rating} \times 0.8, V_{GS} = 0\text{V}, T_C = 125^\circ\text{C}$
$I_{D(on)}$ On-State Drain Current ②	IRFJ440	6.0	—	—	A	$V_{DS} > I_{D(on)} \times R_{DS(on)max.}, V_{GS} = 10\text{V}$
	IRFJ441	—	—	—	A	
	IRFJ442 IRFJ443	5.0	—	—	A	
$R_{DS(on)}$ Static Drain-Source On-State Resistance ②	IRFJ440	—	0.8	0.85	Ω	$V_{GS} = 10\text{V}, I_D = 3.3\text{A}$
	IRFJ441	—	—	—	Ω	
	IRFJ442 IRFJ443	—	1.0	1.1	Ω	
g_{fs} Forward Transconductance ②	ALL	4.0	6.5	—	S (U)	$V_{DS} > I_{D(on)} \times R_{DS(on)max.}, I_D = 3.3\text{A}$
C_{iss} Input Capacitance	ALL	—	1225	1600	pF	$V_{GS} = 0\text{V}, V_{DS} = 25\text{V}, f = 1.0\text{ MHz}$ See Fig. 10
C_{oss} Output Capacitance	ALL	—	200	350	pF	
C_{rss} Reverse Transfer Capacitance	ALL	—	85	150	pF	
$t_{d(on)}$ Turn-On Delay Time	ALL	—	17	35	ns	$V_{DD} = 200\text{V}, I_D = 3.3\text{A}, Z_o = 4.7\Omega$ See Fig. 17 (MOSFET switching times are essentially independent of operating temperature.)
t_r Rise Time	ALL	—	5	15	ns	
$t_{d(off)}$ Turn-Off Delay Time	ALL	—	42	90	ns	
t_f Fall Time	ALL	—	14	30	ns	$V_{GS} = 10\text{V}, I_D = 7.6\text{A}, V_{DS} = 0.8\text{ Max. Rating.}$ See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)
Q_g Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	42	60	nC	
Q_{gs} Gate-Source Charge	ALL	—	20	—	nC	
Q_{gd} Gate-Drain ("Miller") Charge	ALL	—	22	—	nC	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_D Internal Drain Inductance	ALL	—	5.0	—	nH	
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	—	—	1.8	K/W ④	Mounting surface flat, smooth, and greased. Typical socket mount
R_{thCS} Case-to-Sink	ALL	—	0.2	—	K/W ④	
R_{thJA} Junction-to-Ambient	ALL	—	—	50	K/W ④	

IRFJ440, IRFJ441, IRFJ442, IRFJ443 Devices

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Source-Drain Diode Ratings and Characteristics

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I_S	Continuous Source Current (Body Diode)	IRFJ440 IRFJ441	—	—	6.0	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
		IRFJ442 IRFJ443	—	—	5.0	A	
I_{SM}	Pulse Source Current (Body Diode) ③	IRFJ440 IRFJ441	—	—	24	A	
		IRFJ442 IRFJ443	—	—	20	A	
V_{SD}	Diode Forward Voltage ②	IRFJ440 IRFJ441	—	—	2.0	V	$T_C = 25^\circ\text{C}, I_S = 6.0\text{A}, V_{GS} = 0\text{V}$
		IRFJ442 IRFJ443	—	—	1.9	V	$T_C = 25^\circ\text{C}, I_S = 5.2\text{A}, V_{GS} = 0\text{V}$
t_{rr}	Reverse Recovery Time	ALL	—	1100	—	ns	$T_J = 150^\circ\text{C}, I_F = 6.0\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$
Q_{RR}	Reverse Recovered Charge	ALL	—	6.4	—	μC	$T_J = 150^\circ\text{C}, I_F = 6.0\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$
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 $T_J = 25^\circ\text{C}$ to 150°C . ② Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.

③ Repetitive Rating: Pulse width limited by max. junction temperature. See Transient Thermal Impedance Curve (Fig. 5).

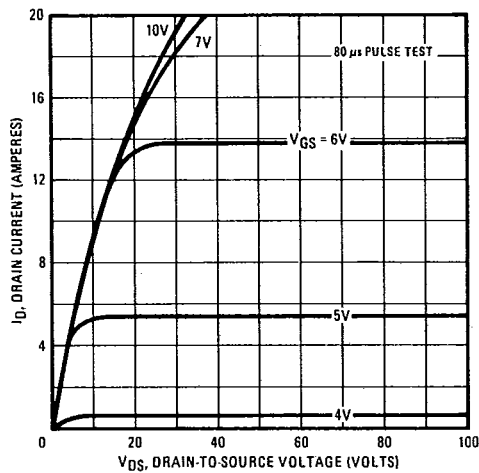
④ $K/W = ^\circ\text{C}/W$
 $W/K = W/^\circ\text{C}$ 

Fig. 1 - Typical Output Characteristics

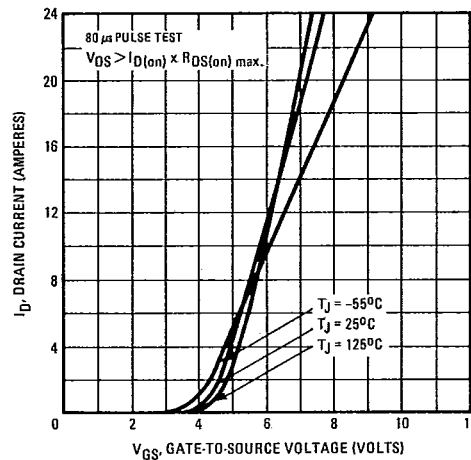


Fig. 2 - Typical Transfer Characteristics

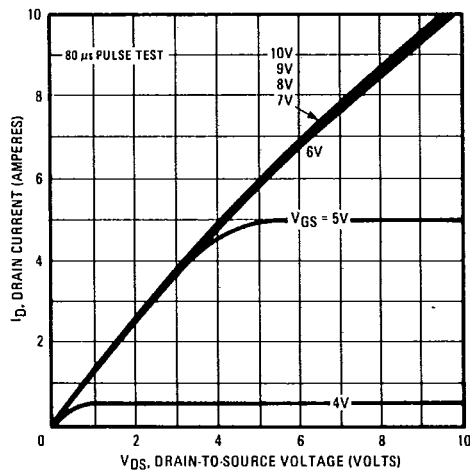


Fig. 3 - Typical Saturation Characteristics

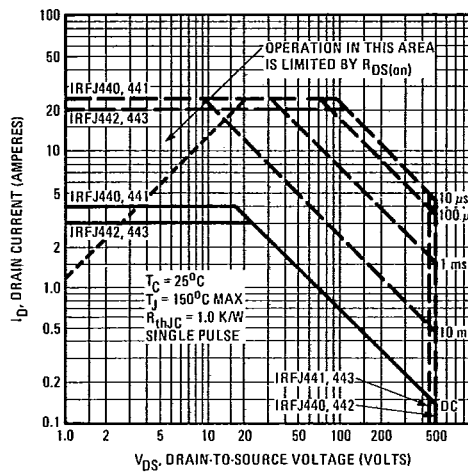


Fig. 4 - Maximum Safe Operating Area

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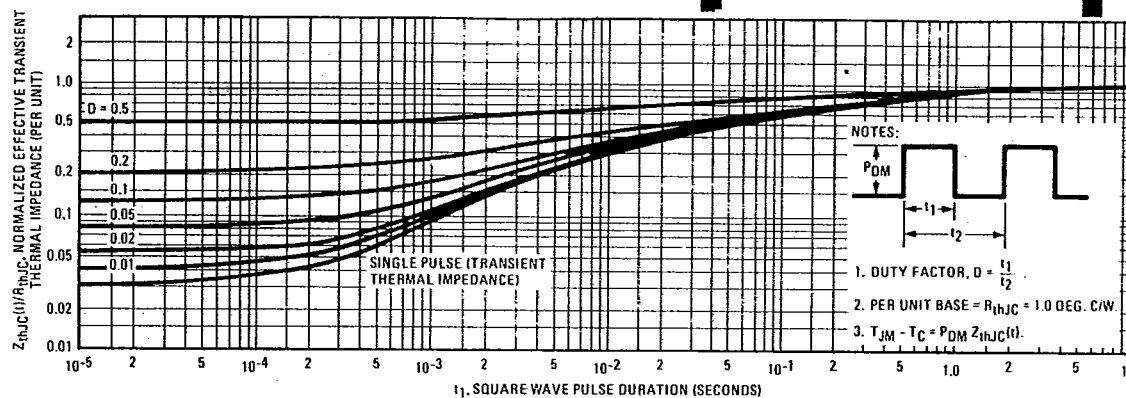


Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

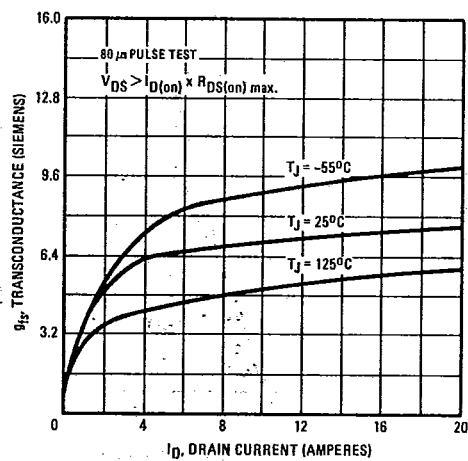


Fig. 6 — Typical Transconductance Vs. Drain Current

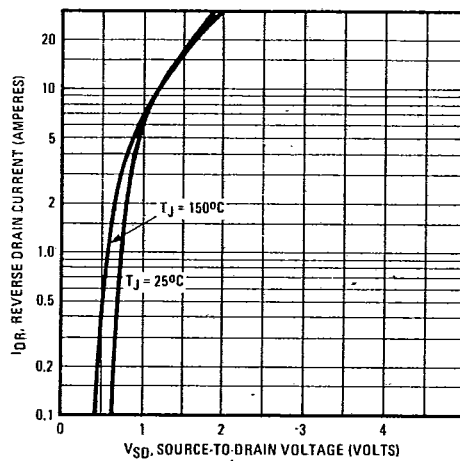


Fig. 7 — Typical Source-Drain Diode Forward Voltage

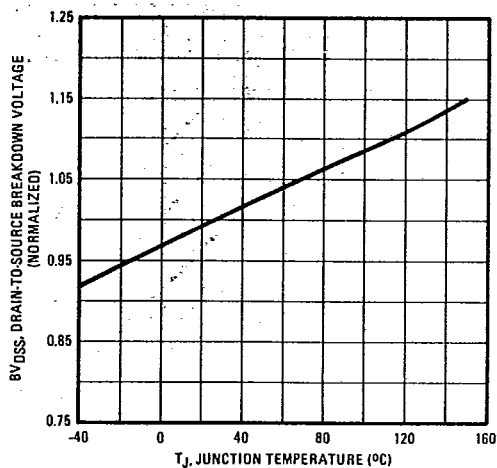


Fig. 8 — Breakdown Voltage Vs. Temperature

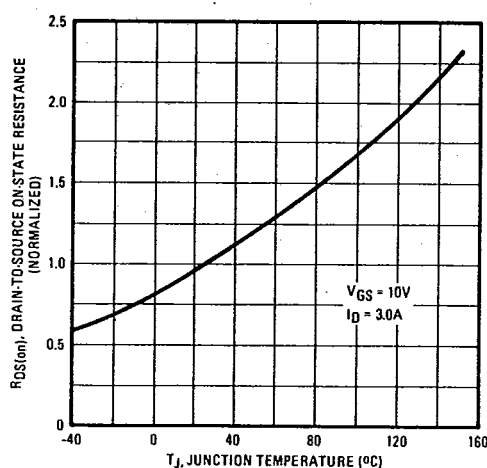


Fig. 9 — Normalized On-Resistance Vs. Temperature

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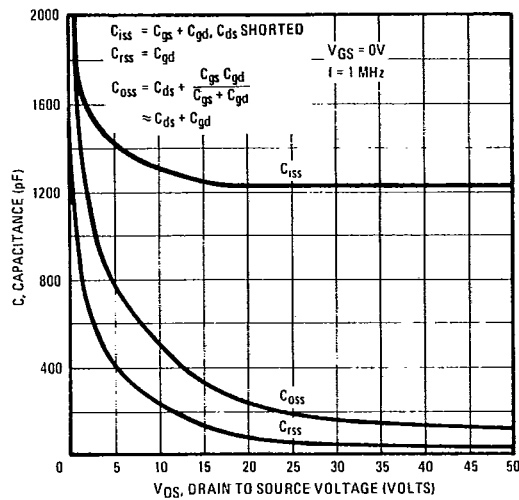


Fig. 10 - Typical Capacitance Vs. Drain-to-Source Voltage

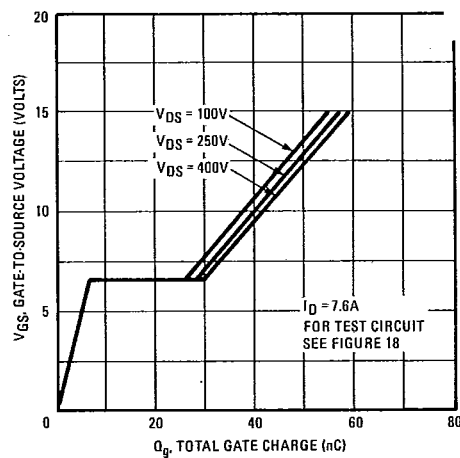


Fig. 11 - Typical Gate Charge Vs. Gate-to-Source Voltage

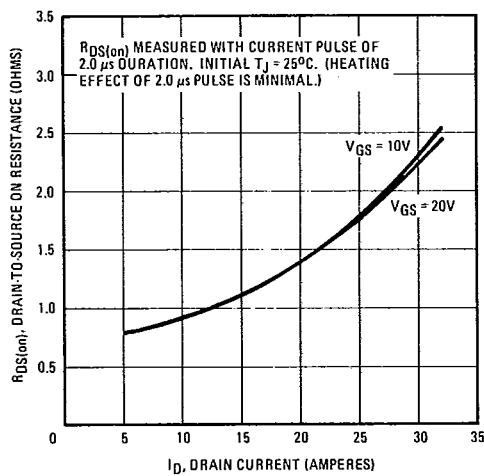


Fig. 12 - Typical On-Resistance Vs. Drain Current

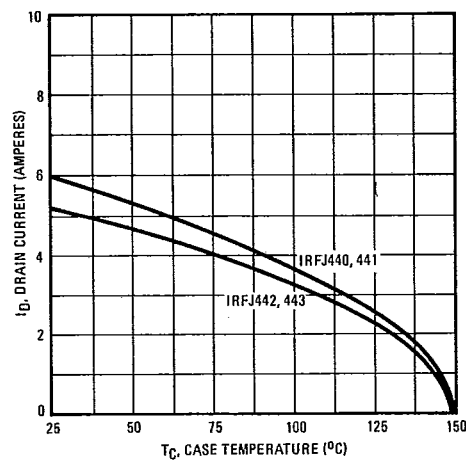


Fig. 13 - Maximum Drain Current Vs. Case Temperature

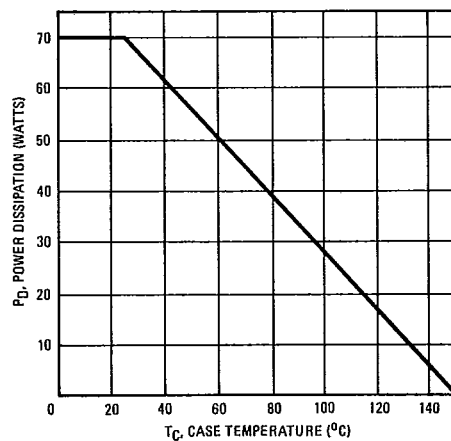


Fig. 14 - Power Vs. Temperature Derating Curve

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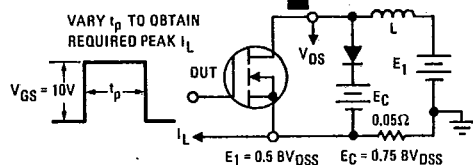


Fig. 15 - Clamped Inductive Test Circuit

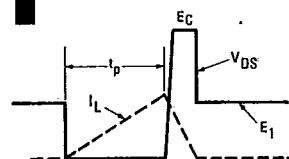


Fig. 16 - Clamped Inductive Waveforms

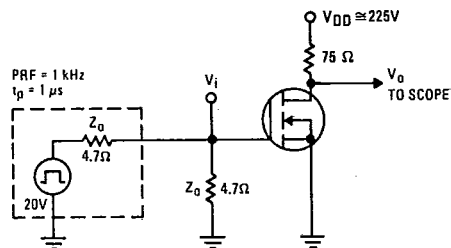


Fig. 17 - Switching Time Test Circuit

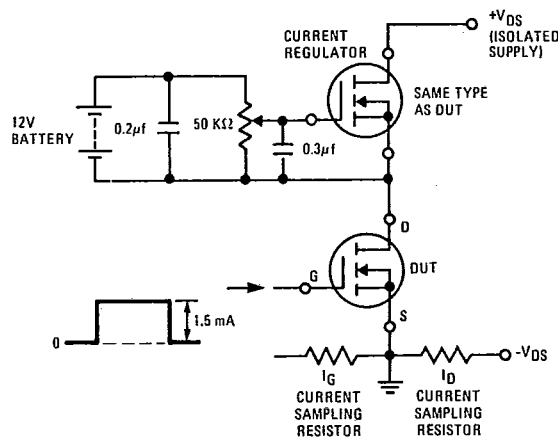


Fig. 18 - Gate Charge Test Circuit