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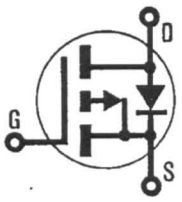
HEXFET® TRANSISTORS

P-CHANNEL POWER MOSFETs TO-39 PACKAGE



IRFF9110
IRFF9111
IRFF9112
IRFF9113

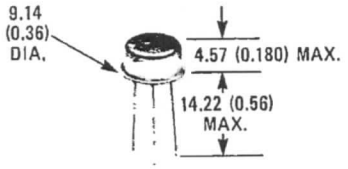
-100 Volt, 1.2 Ohm HEXFET

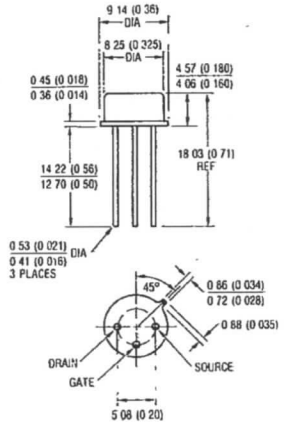
Features:
- P-Channel Versatility
- Fast Switching
- Low Drive Current
- Ease of Paralleling
- Excellent Temperature Stability

Product Summary

Part Number	V_{DS}	$R_{DS(on)}$	I_D
IRFF9110	-100V	1.2Ω	-2.6A
IRFF9111	-60V	1.2Ω	-2.6A
IRFF9112	-100V	1.6Ω	-2.3A
IRFF9113	-60V	1.6Ω	-2.3A

CASE STYLE AND DIMENSIONS





Conforms to JEDEC Outline TO-205AF (TO-39)
Dimensions in Millimeters and (Inches)

IRFF9110, IRFF9111, IRFF9112, IRFF9113 Devices

Absolute Maximum Ratings

Parameter		IRFF9110	IRFF9111	IRFF9112	IRFF9113	Units
V_{DS}	Drain — Source Voltage ①	−100	−60	−100	−60	V
V_{DGR}	Drain — Gate Voltage (R_{GS} = 20 kΩ) ①	−100	−60	−100	−60	V
I_D @ T_C = 25°C	Continuous Drain Current	−2.6	−2.6	−2.3	−2.3	A
I_{DM}	Pulsed Drain Current ③	−10	−10	−9.0	−9.0	A
V_{GS}	Gate — Source Voltage	±20				V
P_D @ T_C = 25°C	Max. Power Dissipation	15 (See Fig. 14)				W
	Linear Derating Factor	0.12 (See Fig. 14)				W/K ④
I_{LM}	Inductive Current, Clamped	(See Fig. 15 and 16) L = 100μH				A
		−10	−10	−9.0	−9.0	
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	IRFF9110 IRFF9112	−100	—	—	V	V_{GS} = 0V
		IRFF9111 IRFF9113	−60	—	—	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 × 0.8, V_{GS} = 0V, T_C = 125°C
$I_{D(on)}$	On-State Drain Current ②	IRFF9110 IRFF9111	−2.6	—	—	A	V_{DS} > $I_{D(on)}$ × $R_{DS(on)}$ max., V_{GS} = −10V
		IRFF9112 IRFF9113	−2.3	—	—	A	
$R_{DS(on)}$	Static Drain — Source On-State Resistance ②	IRFF9110 IRFF9111	—	1.0	1.2	Ω	V_{GS} = −10V, I_D = −1.5A
		IRFF9112 IRFF9113	—	1.2	1.6	Ω	
g_{fs}	Forward Transconductance ②	ALL	0.8	1.1	—	S (℧)	V_{DS} > $I_{D(on)}$ × $R_{DS(on)}$ max., I_D = −1.5A
C_{iss}	Input Capacitance	ALL	—	180	250	pF	V_{GS} = 0V, V_{DS} = −25V, f = 1.0 MHz See Fig. 10
C_{oss}	Output Capacitance	ALL	—	85	100	pF	
C_{rss}	Reverse Transfer Capacitance	ALL	—	30	35	pF	
$t_{d(on)}$	Turn-On Delay Time	ALL	—	15	30	ns	V_{DD} = −50V, I_D = −1.5A, Z_o = 50Ω See Fig. 17 (MOSFET switching times are essentially independent of operating temperature.)
t_r	Rise Time	ALL	—	30	60	ns	
$t_{d(off)}$	Turn-Off Delay Time	ALL	—	20	40	ns	
t_f	Fall Time	ALL	—	20	40	ns	
Q_g	Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	8.5	11	nC	V_{GS} = −15V, I_D = −5.0A, V_{DS} = 0.8V Max. Rating. See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)
Q_{gs}	Gate-Source Charge	ALL	—	3.8	—	nC	
Q_{gd}	Gate-Drain ("Miller") Charge	ALL	—	4.7	—	nC	
L_D	Internal Drain Inductance	ALL	—	5.0	—	nH	Measured from the drain lead, 5mm (0.2 in.) from header to center of die.
L_S	Internal Source Inductance	ALL	—	15	—	nH	Measured from the source lead, 5mm (0.2 in.) from header to source bonding pad.

Modified MOSFET symbol showing the internal device inductances.

Thermal Resistance

R_{thJC}	Junction-to-Case	ALL	—	—	8.33	K/W ④	
R_{thJA}	Junction-to-Ambient	ALL	—	—	175	K/W ④	Typical socket mount

Source-Drain Diode Ratings and Characteristics

I_S	Continuous Source Current (Body Diode)	IRFF9110 IRFF9111	–	–	-2.6	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
		IRFF9112 IRFF9113	–	–	-2.3	A	
I_{SM}	Pulse Source Current (Body Diode) ③	IRFF9110 IRFF9111	–	–	-10	A	
		IRFF9112 IRFF9113	–	–	-9.0	A	
V_{SD}	Diode Forward Voltage ②	IRFF9110 IRFF9111	–	–	-5.5	V	T_C = 25°C, I_S = -2.6A, V_{GS} = 0V
		IRFF9112 IRFF9113	–	–	-5.3	V	T_C = 25°C, I_S = -2.3A, V_{GS} = 0V
t_{rr}	Reverse Recovery Time	ALL	–	120	–	ns	T_J = 150°C, I_F = -2.6A, dI_F/dt = 100A/μs
Q_{RR}	Reverse Recovered Charge	ALL	–	6.0	–	μC	T_J = 150°C, I_F = -2.6A, dI_F/dt = 100A/μs
t_{on}	Forward Turn-on Time	ALL	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by L_S + L_D.				

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

④ K/W = °C/W
W/K = W/°C

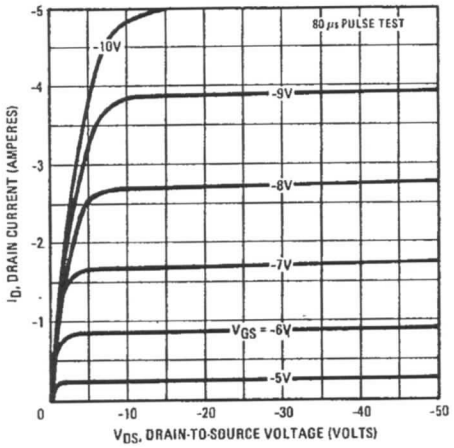


Fig. 1 – Typical Output Characteristics

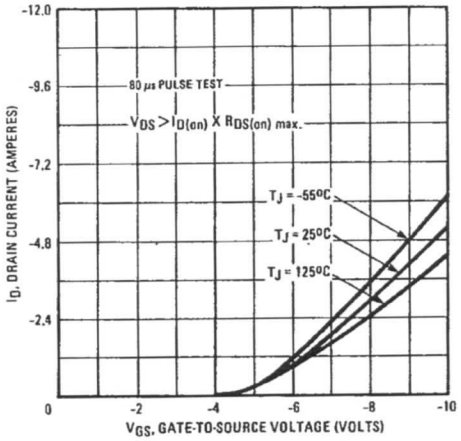


Fig. 2 – Typical Transfer Characteristics

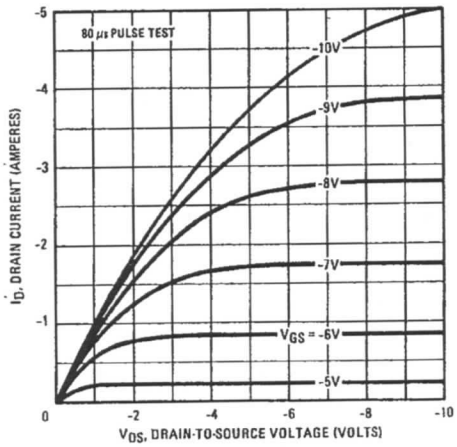


Fig. 3 – Typical Saturation Characteristics

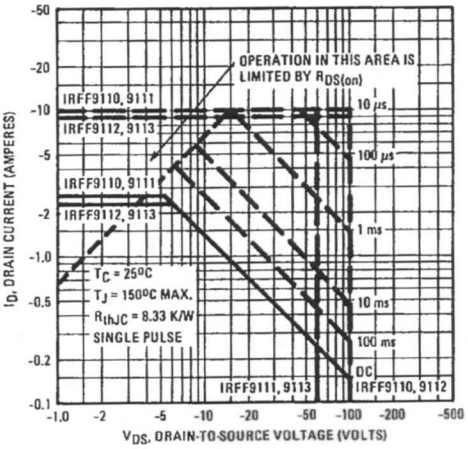


Fig. 4 – Maximum Safe Operating Area