

**IRF9530/9531/9532/9533
IRFP9130/9131/9132/9133**

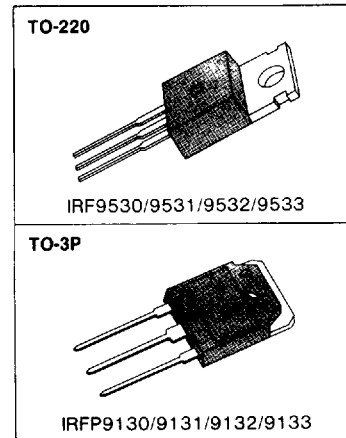
**P-CHANNEL
POWER MOSFETS**

FEATURES

- Lower $R_{DS(on)}$
- Improved inductive ruggedness
- Fast switching times
- Rugged polysilicon gate cell structure
- Lower input capacitance
- Extended safe operating area
- Improved high temperature reliability

PRODUCT SUMMARY

Part Number	V_{DS}	$R_{DS(on)}$	I_D
IRF9530/IRFP9130	-100V	0.30 Ω	-12A
IRF9531/IRFP9131	-60V	0.30 Ω	-12A
IRF9532/IRFP9132	-100V	0.40 Ω	-10A
IRF9533/IRFP9133	-60V	0.40 Ω	-10A



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MAXIMUM RATINGS

Characteristic	Symbol	IRF9530 IRFP9130	IRF9531 IRFP9131	IRF9532 IRFP9132	IRF9533 IRFP9133	Unit
Drain-Source Voltage (1)	V_{DSS}	-100	-60	-100	-60	Vdc
Drain-Gate Voltage ($R_{GS}=1.0M\Omega$)(1)	V_{DGR}	-100	-60	-100	-60	Vdc
Gate-Source Voltage	V_{GS}	± 20				Vdc
Continuous Drain Current $T_C=25^\circ C$	I_D	-12	-12	-10	-10	Adc
Continuous Drain Current $T_C=100^\circ C$	I_D	-7.5	-7.5	-6.5	-6.5	Adc
Drain Current—Pulsed (3)	I_{DM}	-48	-48	-40	-40	Adc
Gate Current—Pulsed	I_{GM}	± 1.5				Adc
Single Pulsed Avalanche Energy (4)	E_{AS}	550				mJ
Avalanche Current	I_{AS}	-12				A
Total Power Dissipation @ $T_C=25^\circ C$ Derate above $25^\circ C$	P_D	75 0.6				Watts W/ $^\circ C$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-55 to 150				$^\circ C$
Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5 seconds	T_L	300				$^\circ C$

- Notes:** (1) $T_J=25^\circ C$ to $150^\circ C$
 (2) Pulse test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
 (3) Repetitive rating: Pulse with limited by max. junction temperature
 (4) $L=8.5mH, V_{dd}=-25V, R_G=25\Omega$, Starting $T_J=25^\circ C$

ELECTRICAL CHARACTERISTICS ($T_C=25^\circ\text{C}$ unless otherwise specified)


Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions
BV_{DSS}	Drain-Source Breakdown Voltage IRF9530/IRFP9130 IRF9532/IRFP9132	-100	—	—	V	$V_{GS}=0V$ $I_D=-250\mu A$
	IRF9531/IRFP9131 IRF9533/IRFP9133	-60	—	—	V	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS}=V_{GS}$, $I_D=-250\mu A$
I_{GSS}	Gate-Source Leakage Forward	—	—	100	nA	$V_{GS}=-20V$
I_{GSS}	Gate-Source Leakage Reverse	—	—	-100	nA	$V_{GS}=20V$
I_{DSS}	Zero Gate Voltage Drain Current	—	—	250	μA	$V_{DS}=\text{Max. Rating}$, $V_{GS}=0V$
		—	—	1000	μA	$V_{DS}=\text{Max. Rating} \times 0.8$, $V_{GS}=0V$, $T_C=125^\circ\text{C}$
$I_{D(on)}$	On-State Drain-Source Current (2) IRF9530/IRFP9130 IRF9531/IRFP9131	-12	—	—	A	$V_{DS} \leq -4.8V$, $V_{GS}=-10V$
	IRF9532/IRFP9132 IRF9533/IRFP9133	-10	—	—	A	
$R_{DS(on)}$	Static Drain-Source On-State Resistance (2) IRF9530/IRFP9130 IRF9531/IRFP9131	—	—	0.3	Ω	$V_{GS}=-10V$, $I_D=-6.5A$
	IRF9532/IRFP9132 IRF9533/IRFP9133	—	—	0.4	Ω	
g_{fs}	Forward Transconductance (2)	2.0	—	—	Ω	$V_{DS} \leq -50V$, $I_D=-6.5A$
C_{iss}	Input Capacitance	—	835	—	pF	$V_{GS}=0V$, $V_{DS}=-25V$, $f=1.0\text{MHz}$
C_{oss}	Output Capacitance	—	357	—	pF	
C_{rss}	Reverse Transfer Capacitance	—	94	—	pF	
$t_{d(on)}$	Turn-On Delay Time	—	—	60	ns	$V_{DD}=0.5BV_{DSS}$, $I_D=-6.5A$, $Z_\theta=50\Omega$ (MOSFET switching times are essentially independent of operating temperature)
t_r	Rise Time	—	—	140	ns	
$t_{d(off)}$	Turn-Off Delay Time	—	—	140	ns	
t_f	Fall Time	—	—	140	ns	
Q_g	Total Gate Charge (Gate-Source Plus Gate-Drain)	—	—	45	nC	$V_{GS}=-15V$, $I_D=-15A$, $V_{DS}=0.8 \text{ Max. Rating}$ (Gate charge is essentially independent of operating temperature.)
Q_{gs}	Gate-Source Charge	—	—	20	nC	
Q_{gd}	Gate-Drain ("Miller") Charge	—	—	25	nC	

THERMAL RESISTANCE

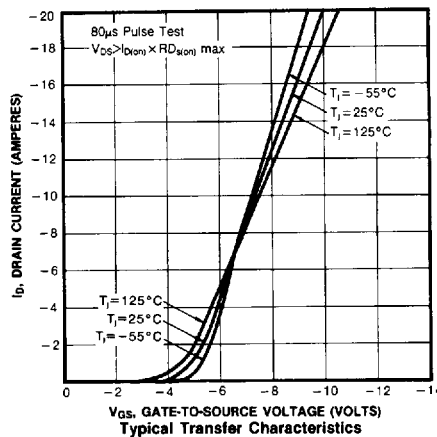
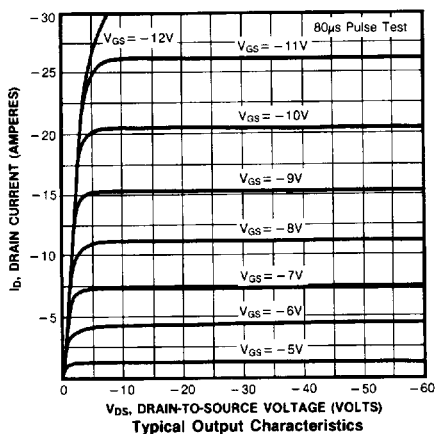
Symbol	Characteristic		IRF9530-3	IRFP9130-3	Unit	
R_{thJC}	Junction-to-Case	MAX	1.67	1.67	K/W	
R_{thCS}	Case-to-Sink	TYP	1.0	0.24	K/W	Mounting surface flat, smooth, and greased
R_{thJA}	Junction-to-Ambient	MAX	80	40	K/W	Free Air Operation

- Notes:** (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

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

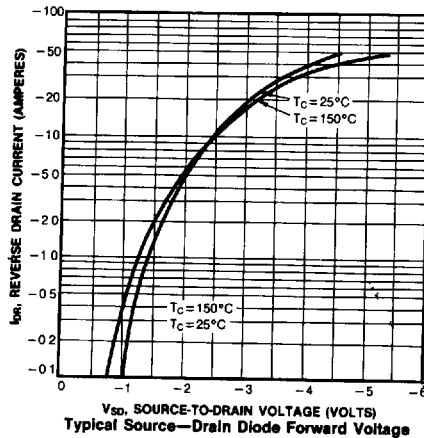
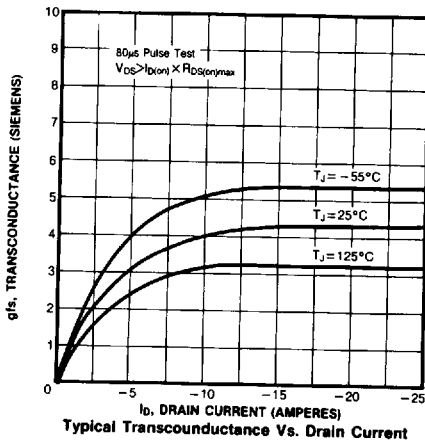
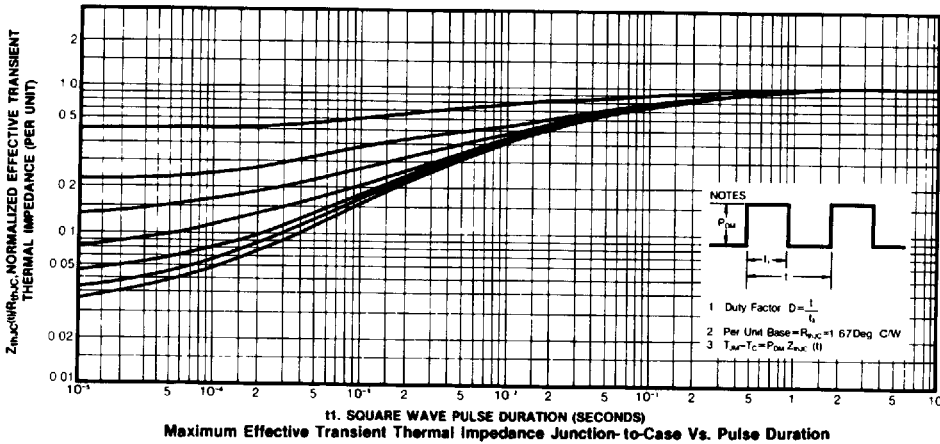
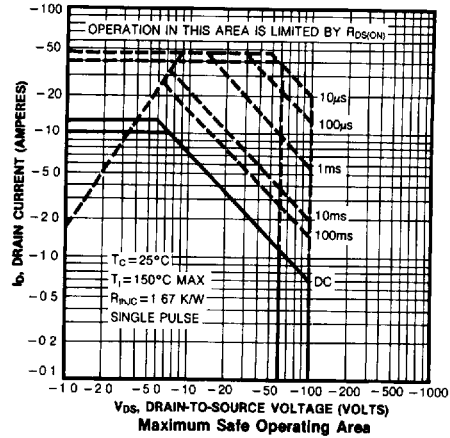
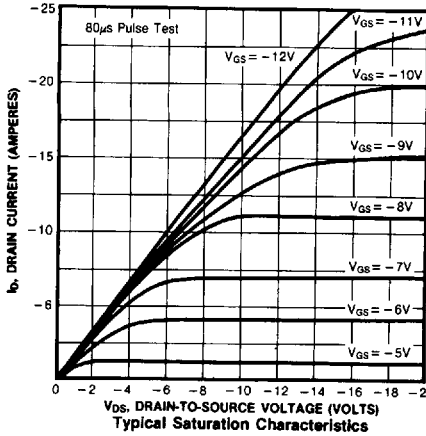
Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions
I_S	Continuous Source Current (Body Diode) IRF9530/IRFP9130 IRF9531/IRFP9131	—	—	-12	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier 
	IRF9532/IRFP9132 IRF9533/IRFP9133	—	—	-10	A	
I_{SM}	Pulse Source Current (Body Diode) (3) IRF9530/IRFP9130 IRF9531/IRFP9131	—	—	-48	A	
	IRF9532/IRFP9132 IRF9533/IRFP9133	—	—	-40	A	
V_{SD}	Diode Forward Voltage (2) IRF9530/IRFP9130 IRF9531/IRFP9131	—	—	-6.3	A	$T_C=25^\circ\text{C}$, $I_S=-12\text{A}$, $V_{GS}=0\text{V}$
	IRF9532/IRFP9132 IRF9533/IRFP9133	—	—	-6.0	A	$T_C=25^\circ\text{C}$, $I_S=-10\text{A}$, $V_{GS}=0\text{V}$
t_{rr}	Reverse Recovery Time	—	300	—	ns	$T_J=150^\circ\text{C}$, $I_F=-6.0\text{A}$, $dI_F/dt=100\text{A}/\mu\text{S}$

Notes: (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 with limited by max. junction temperature



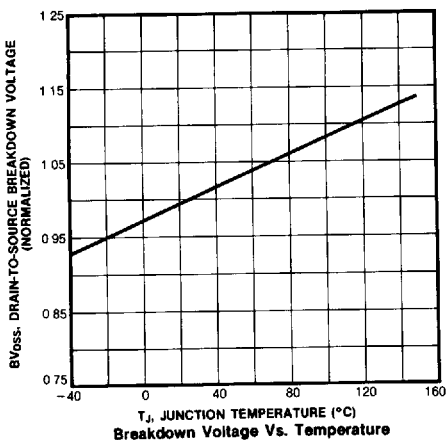
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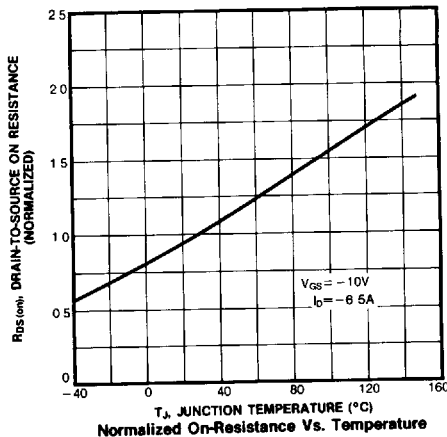


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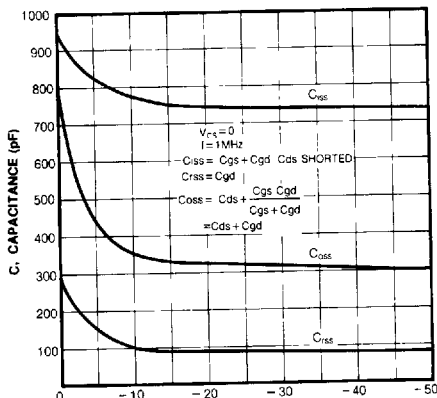
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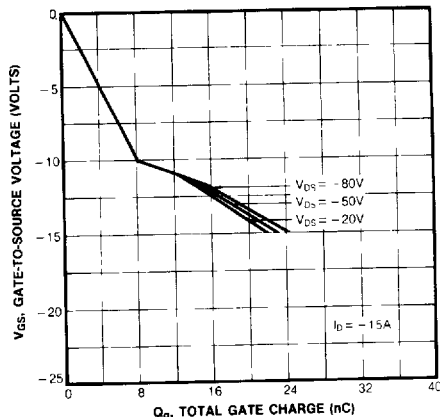
Breakdown Voltage Vs. Temperature



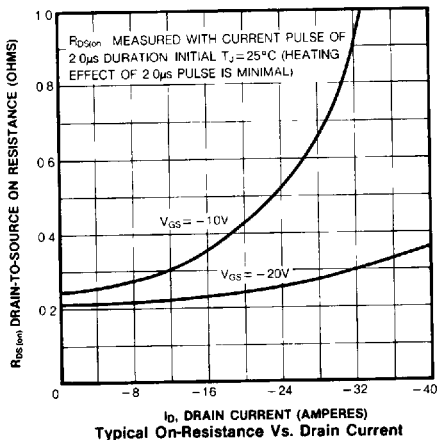
Normalized On-Resistance Vs. Temperature



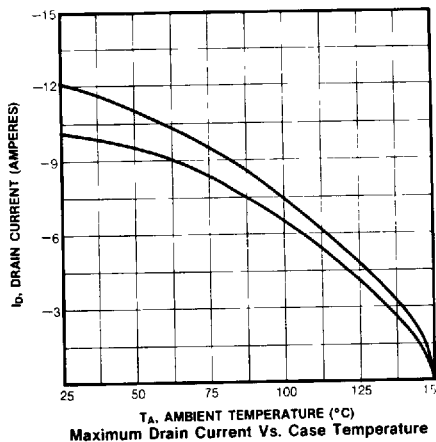
Typical Capacitance Vs. Drain to Source Voltage



Typical Gate Charge Vs. Gate-To-Source Voltage



Typical On-Resistance Vs. Drain Current



Maximum Drain Current Vs. Case Temperature

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