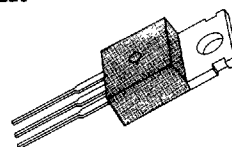


IRF9540/9541/9542/9543
IRFP9140/9141/9142/9143**P-CHANNEL
POWER MOSFETS****FEATURES**

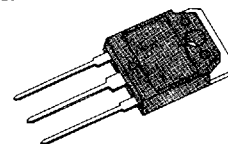
- Lower $R_{DS(on)}$
- Improved inductive ruggedness
- Fast switching times
- Rugged polysilicon gate cell structure
- Lower input capacitance
- Extended safe operating area
- Improved high temperature reliability

TO-220



IRF9540/9541/9542/9543

TO-3P



IRFP9140/9141/9142/9143

PRODUCT SUMMARY

Part Number	V_{DS}	$R_{DS(on)}$	I_D
	-100V	0.2 Ω	-19A
IRF9541/IRFP9141	-60V	0.2 Ω	-19A
IRF9542/IRFP9142	-100V	0.3 Ω	-15A
IRF9543/IRFP9143	-60V	0.3 Ω	-15A

MAXIMUM RATINGS

Characteristic	Symbol		IRF9541 IRFP9141	IRF9542 IRFP9142	IRF9543 IRFP9143	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	-19	-19	-15	-15	Adc
Continuous Drain Current $T_C=100^\circ C$	I_D	-12	-12	-10	-10	Adc
Drain Current—Pulsed (3)	I_{DM}	-70	-70	-60	-60	Adc
Gate Current—Pulsed	I_{GM}	± 1.5				Adc
Single Pulsed Avalanche Energy (4)	E_{AS}	560				mJ
Avalanche Current	I_{AS}	-19				A
Total Power Dissipation @ $T_C=25^\circ C$ Derate above $25^\circ C$	P_D	125 1.0				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) $L=3.5mH$, $V_{dd}=-25V$, $R_G=25\Omega$, Starting $T_J=25^\circ C$

IRF9540/9541/9542/9543
IRFP9140/9141/9142/9143
P-CHANNEL
POWER MOSFETS
ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions
BV_{DS}	Drain-Source Breakdown Voltage IRF9540/IRFP9140 IRF9542/IRFP9142	-100	—	—	V	$V_{GS}=0V$ $I_D=-250\mu A$
	IRF9541/IRFP9141 IRF9543/IRFP9143	-80	—	—	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) IRF9540/IRFP9140 IRF9543/IRFP9143	-19	—	—	A	$V_{DS} \leq -5.7V$, $V_{GS}=-10V$
	IRF9541/IRFP9141 IRF9543/IRFP9143	-15	—	—	A	
$R_{DS(on)}$	Static Drain-Source On-State Resistance (2) IRF9540/IRFP9140 IRF9542/IRFP9142	—	—	0.2	Ω	$V_{GS}=-10V$, $I_D=-10A$
	IRF9541/IRFP9141 IRF9543/IRFP9143	—	—	0.3	Ω	
g_{fs}	Forward Transconductance (2)	5.0	—	—	S	$V_{DS} \leq -50V$, $I_D=-10A$
C_{iss}	Input Capacitance	—	1560	—	pF	$V_{GS}=0V$, $V_{DS}=-25V$, $f=1.0\text{MHz}$
C_{oss}	Output Capacitance	—	240	—	pF	
C_{rss}	Reverse Transfer Capacitance	—	120	—	pF	
$t_{d(on)}$	Turn-On Delay Time	—	20	30	ns	$V_{DD}=0.5BV_{DS}$, $I_D=-10A$, $Z_0=4.7\Omega$ (MOSFET switching times are essentially independent of operating temperature)
t_r	Rise Time	—	10	15	ns	
$t_{d(off)}$	Turn-Off Delay Time	—	13	20	ns	
t_f	Fall Time	—	8.0	12	ns	
Q_g	Total Gate Charge (Gate-Source Plus Gate-Drain)	—	70	90	nC	$V_{GS}=-15V$, $I_D=-24A$, $V_{DS}=0.8 \text{ Max. Rating}$ (Gate charge is essentially independent of operating temperature.)
Q_{gs}	Gate-Source Charge	—	—	30	nC	
Q_{gd}	Gate-Drain ("Miller") Charge	—	—	60	nC	

THERMAL RESISTANCE

Symbol	Characteristic		IRF9540-3	IRFP9140-3	Unit	
R_{thJC}	Junction-to-Case	MAX	1.0	1.0	K/W	
R_{thCS}	Case-to-Sink	TYP	0.5	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

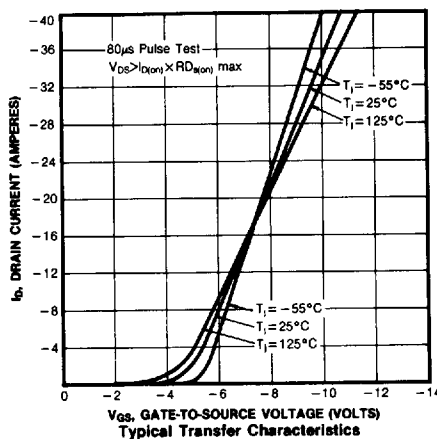
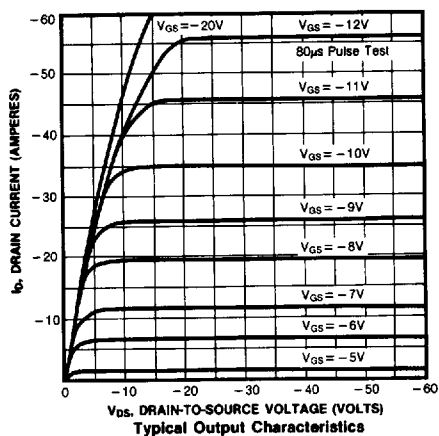
(2) Pulse test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 2\%$

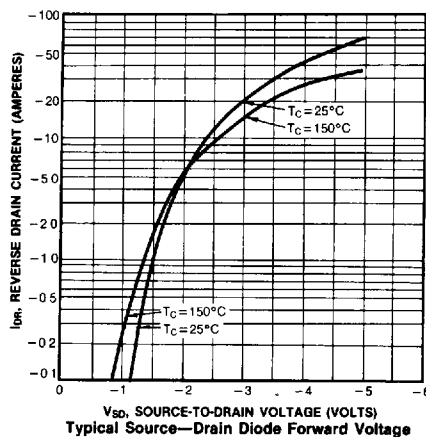
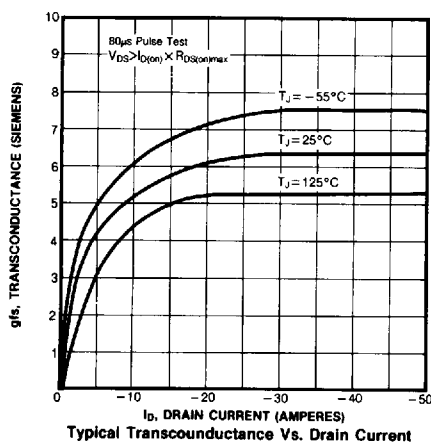
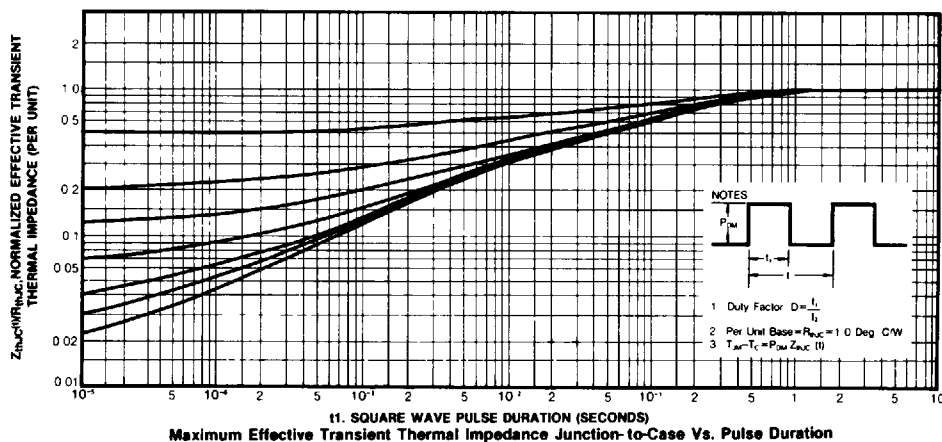
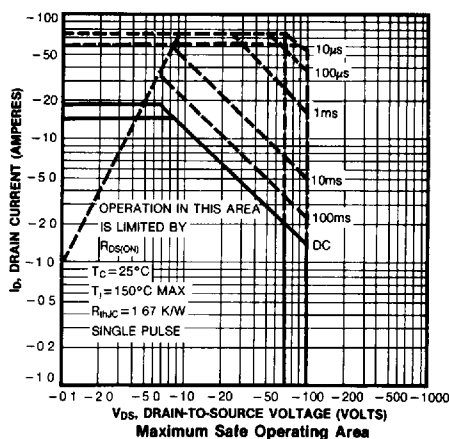
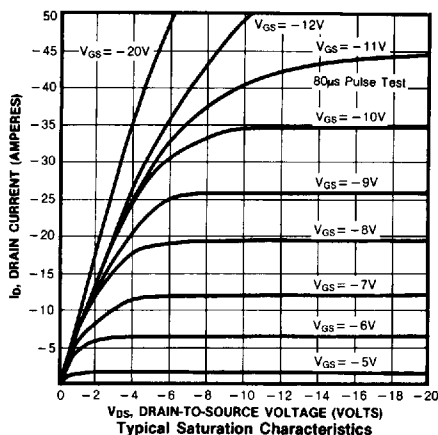
(3) Repetitive rating: Pulse width limited by max. junction temperature

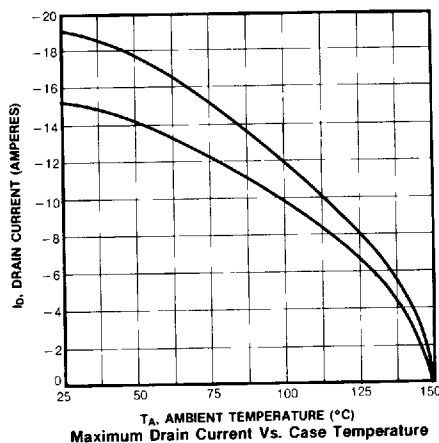
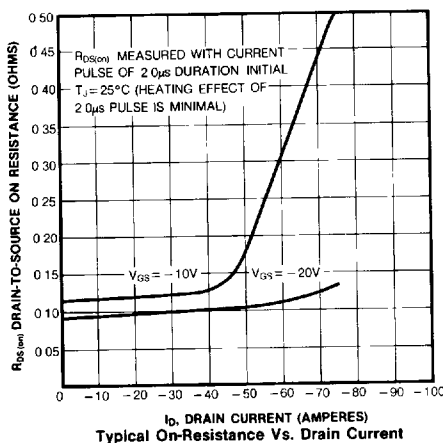
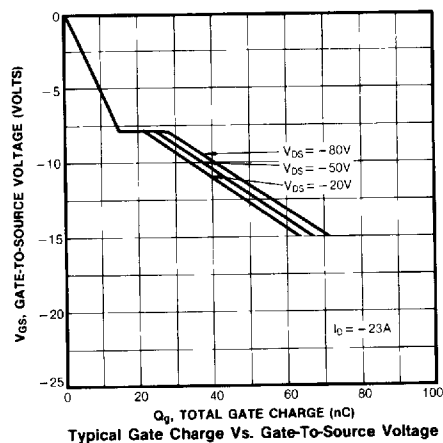
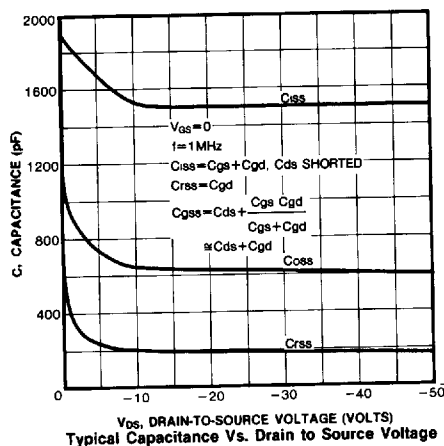
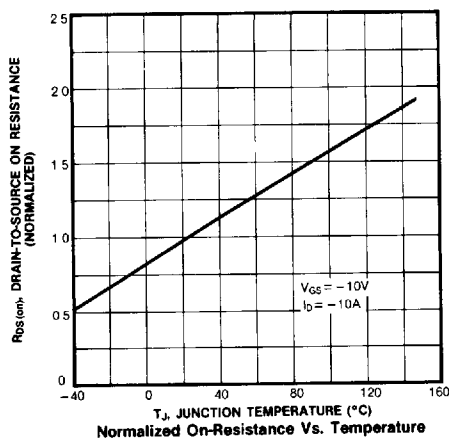
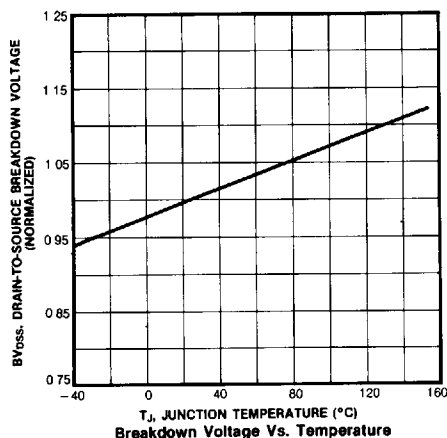
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions
I_S	Continuous Source Current (Body Diode) IRF9540/IRFP9140 IRF9541/IRFP9141	—	—	-19	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier 
	IRF9542/IRFP9142 IRF9543/IRFP9143	—	—	-15	A	
I_{SM}	Pulse Source Current (Body Diode) (3) IRF9540/IRFP9140 IRF9541/IRFP9141	—	—	-76	A	
	IRF9542/IRFP9142 IRF9543/IRFP9143	—	—	-60	A	
V_{SD}	Diode Forward Voltage (2) IRF9540/IRFP9140 IRF9541/IRFP9141	—	—	-4.2	A	$T_C=25^\circ\text{C}$, $I_S=-19\text{A}$, $V_{GS}=0\text{V}$
	IRF9542/IRFP9142 IRF9543/IRFP9143	—	—	-4.0	A	$T_C=25^\circ\text{C}$, $I_S=-15\text{A}$, $V_{GS}=0\text{V}$
t_{rr}	Reverse Recovery Time	—	170	—	ns	$T_J=150^\circ\text{C}$, $I_F=-19\text{A}$, $dI_F/dt=100\text{A}/\mu\text{S}$

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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