

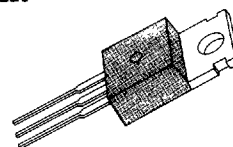
## FEATURES

- 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

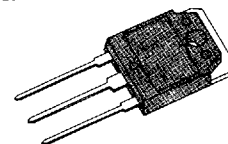
Part Number	$V_{DS}$	$R_{DS(on)}$	$I_D$
	-100V	0.2 $\Omega$	-19A
IRF9541/IRFP9141	-60V	0.2 $\Omega$	-19A
IRF9542/IRFP9142	-100V	0.3 $\Omega$	-15A
IRF9543/IRFP9143	-60V	0.3 $\Omega$	-15A

TO-220



IRF9540/9541/9542/9543

TO-3P



IRFP9140/9141/9142/9143

## 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	$V_{GS}$	$\pm 20$				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	$I_{GM}$	$\pm 1.5$				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  $T_J=25^\circ C$

**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 IRF9540/IRFP9140 IRF9542/IRFP9142	-100	—	—	V	$V_{GS}=0V$ $I_D=-250\mu A$
	IRF9541/IRFP9141 IRF9543/IRFP9143	-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	$\mu A$	$V_{DS}=\text{Max. Rating}$ , $V_{GS}=0V$
		—	—	1000	$\mu A$	$V_{DS}=\text{Max. Rating} \times 0.8$ , $V_{GS}=0V$ , $T_C=125^\circ\text{C}$
$I_{D(on)}$	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	$\Omega$	$V_{GS}=-10V$ , $I_D=-10A$
	IRF9541/IRFP9141 IRF9543/IRFP9143	—	—	0.3	$\Omega$	
$g_{fs}$	Forward Transconductance (2)	5.0	—	—	$\text{U}$	$V_{DS} \leq -50V$ , $I_D=-10A$
$C_{iss}$	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	$V_{DD}=0.5BV_{DSS}$ , $I_D=-10A$ , $Z_\theta=4.7\Omega$ (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  $150^\circ\text{C}$

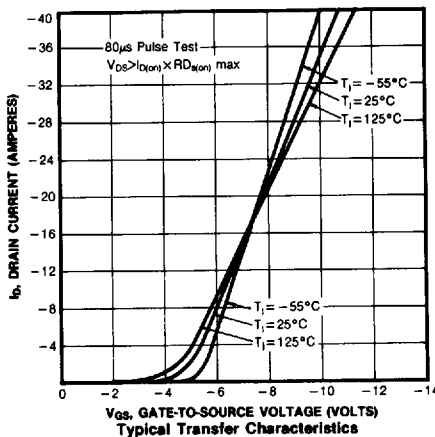
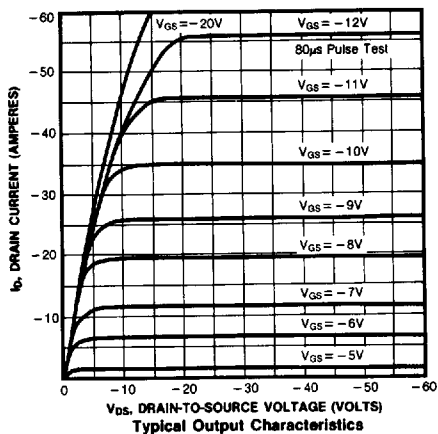
(2) Pulse test: Pulse width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$

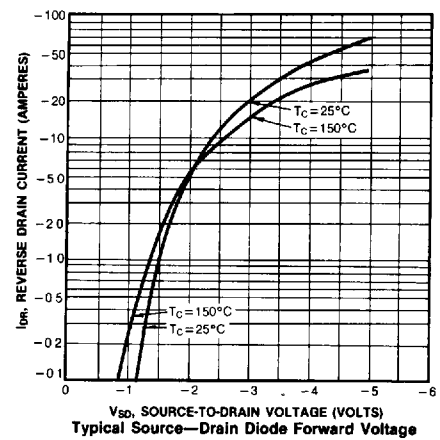
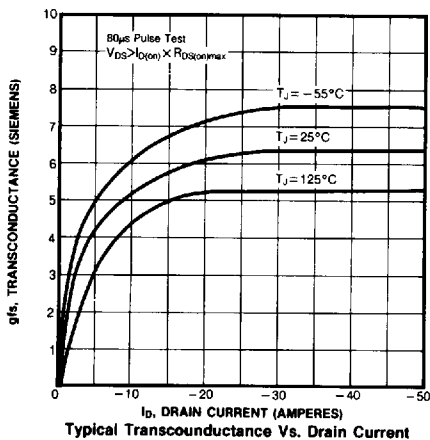
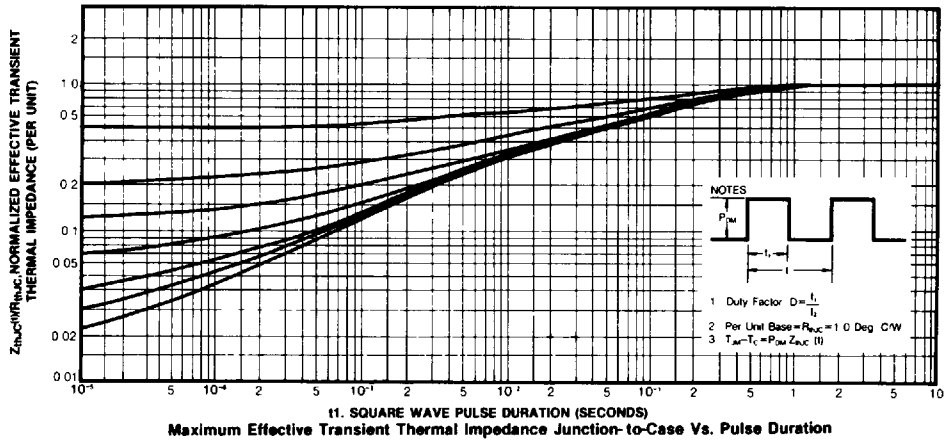
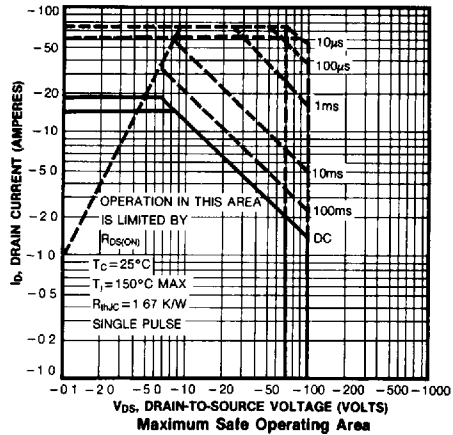
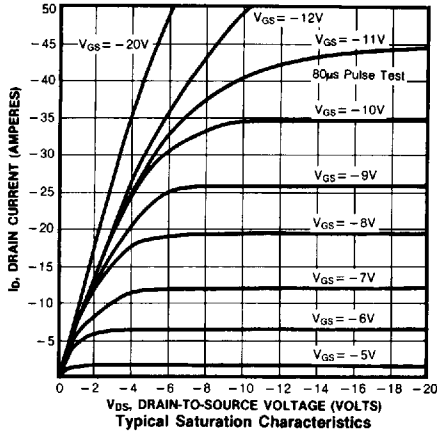
(3) Repetitive rating: Pulse width limited by max. junction temperature

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions
I <sub>S</sub>	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 <sub>SM</sub>	Pulse Source Current (Body Diode) (3) IRF9540/IRFP9140 IRF9541/IRFP9141	—	—	-76	A	
	IRF9542/IRFP9142 IRF9543/IRFP9143	—	—	-60	A	
V <sub>SD</sub>	Diode Forward Voltage (2) IRF9540/IRFP9140 IRF9541/IRFP9141	—	—	-4.2	A	T <sub>C</sub> =25°C, I <sub>S</sub> =-19A, V <sub>GS</sub> =0V
	IRF9542/IRFP9142 IRF9543/IRFP9143	—	—	-4.0	A	T <sub>C</sub> =25°C, I <sub>S</sub> =-15A, V <sub>GS</sub> =0V
t <sub>rr</sub>	Reverse Recovery Time	—	170	—	ns	T <sub>J</sub> =150°C, I <sub>F</sub> =-19A, dI <sub>F</sub> /dt=100A/μS

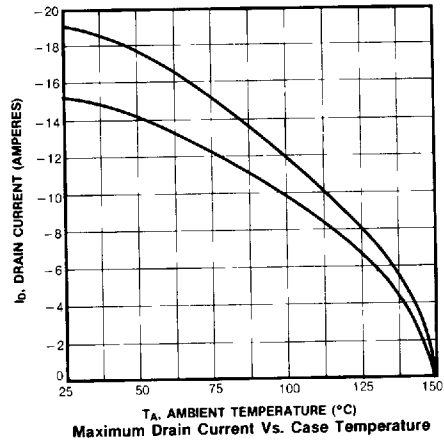
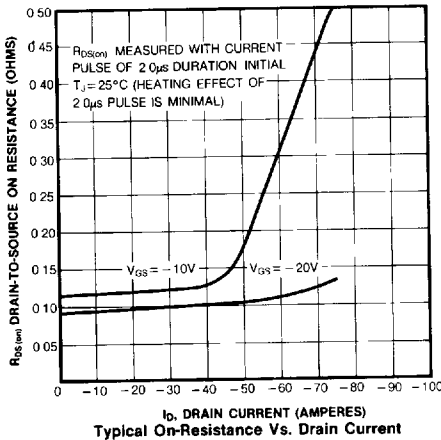
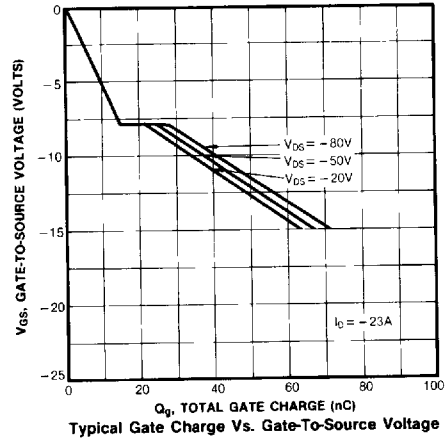
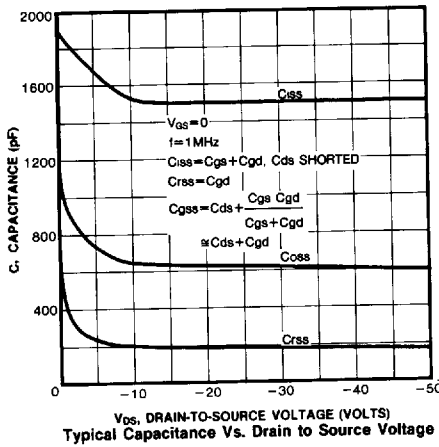
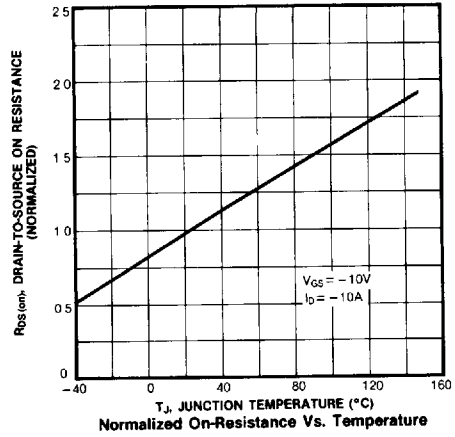
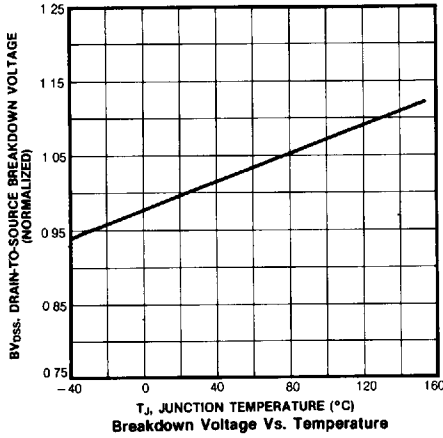
Notes: (1) T<sub>J</sub>=25°C to 150°C (2) Pulse test: Pulse width≤300μs, Duty Cycle≤2%  
 (3) Repetitive rating: Pulse with limited by max. junction temperature





**IRF9540/9541/9542/9543**  
**IRFP9140/9141/9142/9143**

**P-CHANNEL**  
**POWER MOSFETS**



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**IRF9540/9541/9542/9543**  
**IRFP9140/9141/9142/9143**

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