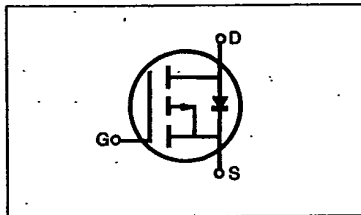


**IRF9130/9131/9132/9133****IRFP9130/9131/9132/9133****IRF9530/9531/9532/9533****P-CHANNEL****POWER MOSFETS****Preliminary Specifications****-100 Volt, 0.30 Ohm SFET****FEATURES**

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

**PRODUCT SUMMARY**

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

**PACKAGE STYLE**

Package Type	Part Number
TO-3	IRF9130/9131/9132/9133
TO-3P	IRFP9130/9131/9132/9133
TO-220	IRF9530/9531/9532/9533

**MAXIMUM RATINGS**

Characteristic	Symbol	IRF/IRFP				Unit
		9130 9530	9131 9531	9132 9532	9133 9533	
Drain-Source Voltage (1)	$V_{DS}$	-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 $T_C=25^\circ C$	$I_D$	-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	$I_{GM}$	$\pm 1.5$				Adc
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 Rangy	$T_J, T_{stg}$	-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 width limited by max. junction temperature

**SAMSUNG SEMICONDUCTOR**

404

**IRF9130/9131/9132/9133****IRFP9130/9131/9132/9133****IRF9530/9531/9532/9533****P-CHANNEL  
POWER MOSFETS**

78 DE 7964142 0005406 7

T-39-21

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

Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Drain-Source Breakdown Voltage	$BV_{DSS}$	IRF9130/2 IRFP9130/2 IRF9530/2	-100	—	—	V	$V_{GS}=0V$
		IRF9131/3 IRFP9131/3 IRF9531/3	-60	—	—	V	$I_D=-250\mu A$
Gate Threshold Voltage	$V_{GS(th)}$	ALL	-2.0	—	-4.0	V	$V_{DS}=V_{GS}$ , $I_D=-250\mu A$
Gate-Source Leakage Forward	$I_{GSS}$	ALL	—	—	-100	nA	$V_{GS}=-20V$
Gate-Source Leakage Reverse	$I_{GSS}$	ALL	—	—	100	nA	$V_{GS}=20V$
Zero Gate Voltage Drain Current	$I_{DSS}$	ALL	—	—	-250	$\mu A$	$V_{DS}=\text{Max. Rating}$ , $V_{GS}=0V$
			—	—	-1000	$\mu A$	$V_{DS}=\text{Max. Rating} \times 0.8$ , $V_{GS}=0V$ , $T_C=125^\circ\text{C}$
On-State Drain-Source Current (2)	$I_{D(on)}$	IRF9130/1 IRFP9130/1 IRF9530/1	-12	—	—	A	$V_{DS}>I_{D(on)} \times R_{DS(on) \text{ max.}}$ , $V_{GS}=-10V$
		IRF9132/3 IRFP9132/3 IRF9532/3	-10	—	—	A	
Static Drain-Source On-State Resistance (2)	$R_{DS(on)}$	IRF9130/2 IRFP9130/2 IRF9530/2	—	—	0.30	$\Omega$	$V_{GS}=-10V$ , $I_D=-6.5A$
		IRF9131/3 IRFP9131/3 IRF9531/3	—	—	0.40	$\Omega$	
Forward Transconductance (2)	$g_{fs}$	ALL	2.0	—	—	S	$V_{DS}>I_{D(on)} \times R_{DS(on) \text{ max.}}$ , $I_D=-6.5A$
Input Capacitance	$C_{iss}$	ALL	—	—	700	pF	$V_{GS}=0V$ , $V_{DS}=-25V$ , $f=1.0\text{MHz}$
Output Capacitance	$C_{oss}$	ALL	—	—	450	pF	
Reverse Transfer Capacitance	$C_{res}$	ALL	—	—	200	pF	
Turn-On Delay Time	$t_{d(on)}$	ALL	—	—	60	ns	$V_{DD}=0.5BV_{DSS}$ , $I_D=-6.5A$ , $Z_\theta=50\Omega$ (MOSFET switching times are essentially independent of operating temperature.)
Rise Time	$T_r$	ALL	—	—	140	ns	
Turn-Off Delay Time	$t_{d(off)}$	ALL	—	—	140	ns	
Fall Time	$t_f$	ALL	—	—	140	ns	
Total Gate Charge (Gate-Source Plus Gate-Drain)	$Q_g$	ALL	—	—	45	nC	$V_{GS}=-15V$ , $I_D=-15A$ , $V_{DS}=0.8 \text{ Max.}$ Rating (Gate charge is essentially independent of operating temperature.)
Gate-Source Charge	$Q_{gs}$	ALL	—	—	20	nC	
Gate-Drain ("Miller") Charge	$Q_{gd}$	ALL	—	—	25	nC	

**THERMAL RESISTANCE**

Junction-to-Case	$R_{thJC}$	ALL	—	—	1.67	K/W	
Case-to-Sink	$R_{thCS}$	ALL	—	1.0	—	K/W	Mounting surface flat, smooth, and greased
Junction-to-Ambient	$R_{thJA}$	IRFPXXXX IRF95XX	—	—	80	K/W	Free Air Operation
		IRF91XX	—	—	30	K/W	

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

IRF9130/9131/9132/9133

98

DE

7964142 0005407 0

IRFP9130/9131/9132/9133

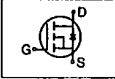
P-CHANNEL

IRF9530/9531/9532/9533

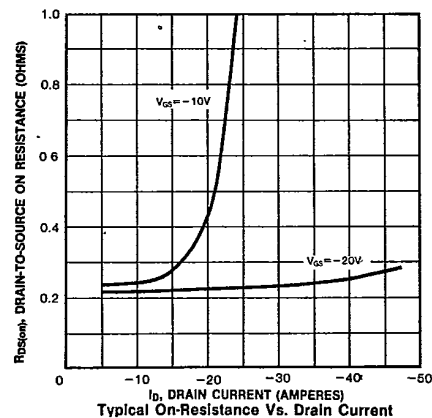
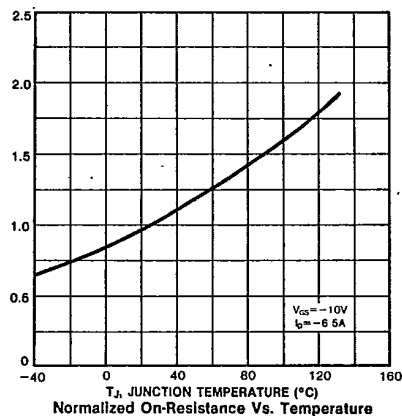
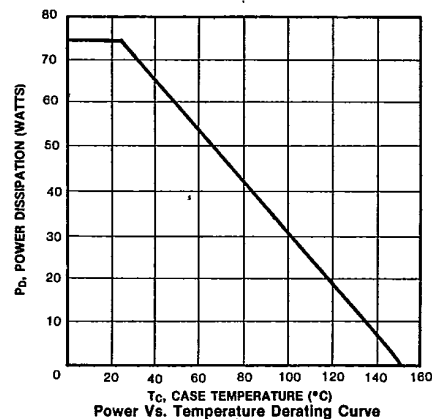
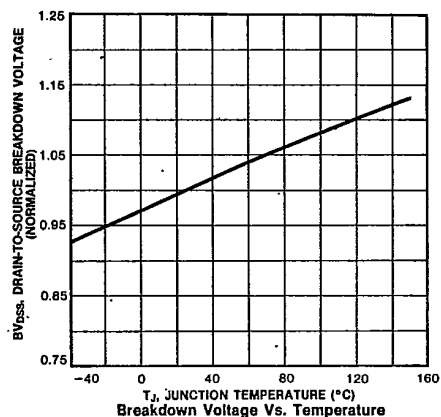
POWER MOSFETS

T-39-21

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Continuous Source Current (Body Diode)	$I_S$	IRF9130/1 IRFP9130/1 IRF9530/1	—	—	-12	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier 
		IRF9132/3 IRFP9132/3 IRF9532/3	—	—	-10	A	
		IRF9130/1 IRFP9130/1 IRF9530/1	—	—	-48	A	
Pulse Source Current (Body Diode) (3)	$I_{SM}$	IRF9130/1 IRFP9130/1 IRF9530/1	—	—	-48	A	$T_C=25^\circ\text{C}$ , $I_S=-12\text{A}$ , $V_{GS}=0\text{V}$
		IRF9132/3 IRFP9132/3 IRF9532/3	—	—	-40	A	
		IRF9130/1 IRFP9130/1 IRF9530/1	—	—	-6.3	V	
Diode Forward Voltage (2)	$V_{SD}$	IRF9130/1 IRFP9130/1 IRF9530/1	—	—	-6.3	V	$T_C=25^\circ\text{C}$ , $I_S=-10\text{A}$ , $V_{GS}=0\text{V}$
		IRF9132/3 IRFP9132/3 IRF9532/3	—	—	-6.0	V	
		IRF9130/1 IRFP9130/1 IRF9530/1	—	—	-6.3	V	
Reverse Recovery Time	$t_{rr}$	ALL	—	—	—	ns	$T_J=150^\circ\text{C}$ , $I_F=-12\text{A}$ , $dI_F/dt=100\text{A}/\mu\text{s}$

Notes: (1)  $T_J=25^\circ\text{C}$  to  $150^\circ\text{C}$  (2) Pulse test: Pulse width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$   
 (3) Repetitive rating: Pulse width limited by max. junction temperature



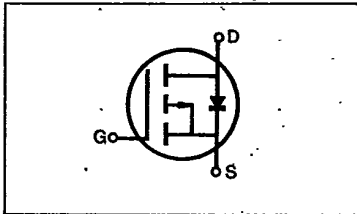
SAMSUNG SEMICONDUCTOR

**IRF9140/9141/9142/9143**  
**IRFP9140/9141/9142/9143**  
**IRF9540/9541/9542/9543**

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

### Preliminary Specifications

— 100 Volt, 0.2 Ohm SFET



### FEATURES

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

### PRODUCT SUMMARY

Part Number	$V_{DS}$	$R_{DS(on)}$	$I_D$
IRF/IRFP9140, IRF9540	—100V	0.2 $\Omega$	—19A
IRF/IRFP9141, IRF9541	—60V	0.2 $\Omega$	—19A
IRF/IRFP9142, IRF9542	—100V	0.3 $\Omega$	—15A
IRF/IRFP9143, IRF9543	—60V	0.3 $\Omega$	—15A

### PACKAGE STYLE

Package Type	Part Number
TO-3	IRF9140/9141/9142/9143
TO-3P	IRFP9140/9141/9142/9143
TO-220	IRF9540/9541/9542/9543

### MAXIMUM RATINGS

Characteristic	Symbol	IRF/IRFP				Unit
		9140 9540	9141 9541	9142 9542	9143 9543	
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)	$I_{DM}$	—76	—76	—60	—60	Adc
Gate Current—Pulsed	$I_{GM}$	$\pm 1.5$				Adc
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 width limited by max. junction temperature



SAMSUNG SEMICONDUCTOR

**IRF9140/9141/9142/9143**  
**IRFP9140/9141/9142/9143**  
**IRF9540/9541/9542/9543**

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

T-39-23

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

Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Drain-Source Breakdown Voltage	$BV_{DS}$	IRF9140/2 IRFP9140/2 IRF9540/2	-100	—	—	V	$V_{GS}=0V$
		IRF9141/3 IRFP9141/2 IRF9541/3	-60	—	—	V	$I_D=-250\mu A$
Gate Threshold Voltage	$V_{GS(th)}$	ALL	-2.0	—	-4.0	V	$V_{DS}=V_{GS}$ , $I_D=-250\mu A$
Gate-Source Leakage Forward	$I_{GSS}$	ALL	—	—	-100	nA	$V_{GS}=-20V$
Gate-Source Leakage Reverse	$I_{GSS}$	ALL	—	—	100	nA	$V_{GS}=20V$
Zero Gate Voltage Drain Current	$I_{DSS}$	ALL	—	—	-250	$\mu A$	$V_{DS}=\text{Max. Rating}$ , $V_{GS}=0V$
		ALL	—	—	-1000	$\mu A$	$V_{DS}=\text{Max. Rating} \times 0.8$ , $V_{GS}=0V$ , $T_C=125^\circ\text{C}$
On-State Drain-Source Current(2)	$I_{D(on)}$	IRF9140/1 IRFP9140/1 IRF9540/1	-19	—	—	A	$V_{DS}>I_{D(on)} \times R_{DS(on) \text{ max.}}$ , $V_{GS}=-10V$
		IRF9142/3 IRFP9142/3 IRF9542/3	-15	—	—	A	
Static Drain-Source On-State Resistance (2)	$R_{DS(on)}$	IRF9140/1 IRFP9140/1 IRF9540/1	—	—	0.2	$\Omega$	$V_{GS}=-10V$ , $I_D=-10A$
		IRF9142/3 IRFP9142/3 IRF9542/3	—	—	0.3	$\Omega$	
Forward Transconductance (2)	$g_{fs}$	ALL	5.0	—	—		$V_{DS}>I_{D(on)} \times R_{DS(on) \text{ max.}}$ , $I_D=-10A$
Input Capacitance	$C_{iss}$	ALL	—	—	1300	pF	$V_{GS}=0V$ , $V_{DS}=-25V$ , $f=1.0\text{MHz}$
Output Capacitance	$C_{oss}$	ALL	—	—	700	pF	
Reverse Transfer Capacitance	$C_{rss}$	ALL	—	—	400	pF	
Turn-On Delay Time	$t_{d(on)}$	ALL	—	—	30	ns	$V_{DD}=0.5BV_{DS}$ , $I_D=-10A$ , $Z_\theta=4.7^\circ\text{C/W}$ , (MOSFET switching times are essentially independent of operating temperature.)
Rise Time	$t_r$	ALL	—	—	15	ns	
Turn-Off Delay Time	$t_{d(off)}$	ALL	—	—	20	ns	
Fall Time	$t_f$	ALL	—	—	12	ns	
Total Gate Charge (Gate-Source Plus Gate-Drain)	$Q_0$	ALL	—	—	90	nC	$V_{GS}=-15V$ , $I_D=-24A$ , $V_{DS}=0.8 \text{ Max.}$ Rating (Gate charge is essentially independent of operating temperature.)
Gate-Source Charge	$Q_{gs}$	ALL	—	—	30	nC	
Gate-Drain ("Miller") Charge	$Q_{gd}$	ALL	—	—	60	nC	

**THERMAL RESISTANCE**

Junction-to-Case	$R_{thJC}$	ALL	—	—	1.0	K/W	
Case-to-Sink	$R_{thCS}$	ALL	—	0.1	—	K/W	Mounting surface flat, smooth, and greased
Junction-to-Ambient	$R_{thJA}$	IRFPXXXX IRF95XX	—	—	80	K/W	Free Air Operation
		IRF91XX	—	—	30	K/W	

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

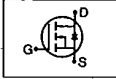


SAMSUNG SEMICONDUCTOR

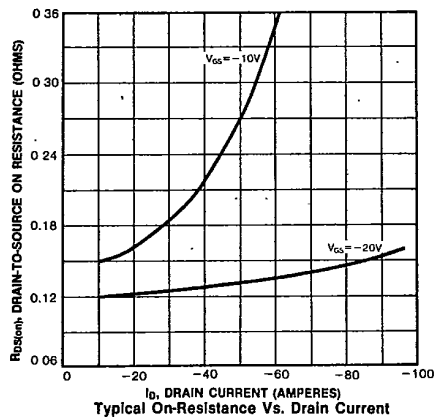
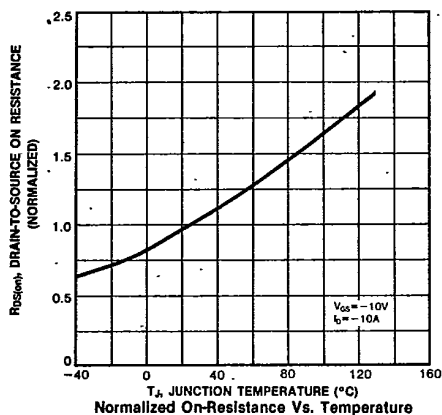
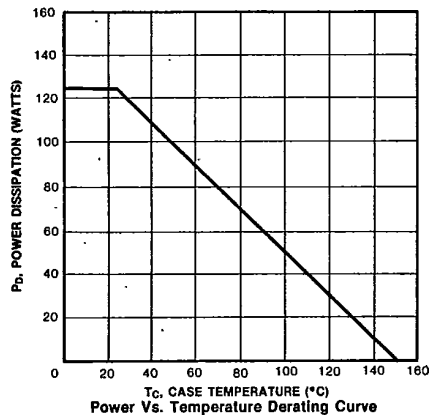
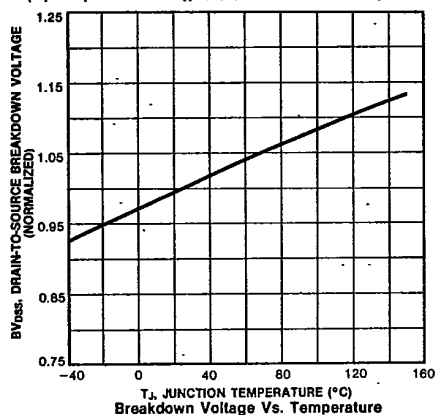
**IRF9140/9141/9142/9143**  
**IRFP9140/9141/9142/9143**  
**IRF9540/9541/9542/9543**

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

### SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Continuous Source Current (Body Diode)	$I_S$	IRF9140/1 IRFP9140/1 IRF9540/1	—	—	-19	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier 
		IRF9142/3 IRFP9142/3 IRF9542/3	—	—	-15	A	
Pulse Source Current (Body Diode) (3)	$I_{SM}$	IRF9140/1 IRFP9140/1 IRF9540/1	—	—	-76	A	
		IRF9142/3 IRFP9142/3 IRF9542/3	—	—	-60	A	
Diode Forward Voltage (2)	$V_{SD}$	IRF9140/1 IRFP9140/1 IRF9540/1	—	—	-4.2	V	$T_C=25^\circ\text{C}$ , $I_S=-19\text{A}$ , $V_{GS}=0\text{V}$
		IRF9142/3 IRFP9142/3 IRF9542/3	—	—	-4.0	V	$T_C=25^\circ\text{C}$ , $I_S=-15\text{A}$ , $V_{GS}=0\text{V}$
Reverse Recovery Time	$t_{rr}$	ALL	—	—	—	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  $150^\circ\text{C}$  (2) Pulse test: Pulse width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$   
(3) Repetitive rating: Pulse width limited by max. junction temperature



**IRF9230/9231/9232/9233**  
**IRFP9230/9231/9232/9233**  
**IRF9630/9631/9632/9633**

98

DE

7964142 0005417 3

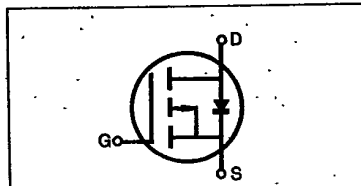
**P-CHANNEL**

**POWER MOSFETS**

*Preliminary Specifications*

**T-39-21**

**- 200 Volt, 0.8 Ohm SFET**



**PRODUCT SUMMARY**

Part Number	V <sub>DS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
IRF/IRFP9230, IRF9630	-200V	0.8Ω	-6.5A
IRF/IRFP9231, IRF9631	-150V	0.8Ω	-6.5A
IRF/IRFP9232, IRF9632	-200V	1.2Ω	-5.5A
IRF/IRFP9233, IRF9633	-150V	1.2Ω	-5.5A

7964142 SAMSUNG SEMICONDUCTOR INC

98D 05417 D

**FEATURES**

- Low R<sub>DS(on)</sub>
- Improved inductive ruggedness
- Fast switching times
- Rugged polysilicon gate cell structure
- Low input capacitance
- Extended safe operating area
- Improved high temperature reliability

**PACKAGE STYLE**

Package Type	Part Number
TO-3	IRF9230/9231/9232/9233
TO-3P	IRFP9230/9231/9232/9233
TO-220	IRF9630/9631/9632/9633

**MAXIMUM RATINGS**

Characteristic	Symbol	IRF/IRFP				Unit
		9230 9630	9231 9631	9232 9632	9233 9633	
Drain-Source Voltage (1)	V <sub>DSS</sub>	-200	-150	-200	-150	V <sub>dc</sub>
Drain-Gate Voltage (R <sub>GS</sub> =1.0MΩ) (1)	V <sub>DGR</sub>	-200	-150	-200	-150	V <sub>dc</sub>
Gate-Source Voltage	V <sub>GS</sub>	±20				V <sub>dc</sub>
Continuous Drain Current T <sub>C</sub> =25°C	I <sub>D</sub>	-6.5	-6.5	-5.5	-5.5	A <sub>dc</sub>
Continuous Drain Current T <sub>C</sub> =100°C	I <sub>D</sub>	-4.0	-4.0	-3.5	-3.5	A <sub>dc</sub>
Drain Current—Pulsed (3)	I <sub>DM</sub>	-26	-26	-22	-22	A <sub>dc</sub>
Gate Current—Pulsed	I <sub>GM</sub>	±1.5				A <sub>dc</sub>
Total Power Dissipation @ T <sub>C</sub> =25°C Derate above 25°C	P <sub>D</sub>	75 0.6				Watts W/°C
Operating and Storage Junction Temperature Rangy	T <sub>J</sub> , T <sub>stg</sub>	-55 to 150				°C
Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5 seconds	T <sub>L</sub>	300				°C

Notes: (1) T<sub>J</sub>=25°C to 150°C

(2) Pulse test: Pulse width≤300μs, Duty Cycle≤2%

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



**SAMSUNG SEMICONDUCTOR**

IRF9230/9231/9232/9233

IRFP9230/9231/9232/9233

IRF9630/9631/9632/9633

7964142 0005418 5

P-CHANNEL

POWER MOSFETS

7964142 SAMSUNG SEMICONDUCTOR INC

98D 05418 D

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

T-39-21

Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Drain-Source Breakdown Voltage	$BV_{DS}$	IRF9230/2 IRFP9230/2 IRF9630/2	-200	—	—	V	$V_{GS}=0V$
		IRF9231/3 IRFP9231/3 IRF9631/3	-150	—	—	V	$I_D=-250\mu A$
Gate Threshold Voltage	$V_{GS(th)}$	ALL	-2.0	—	-4.0	V	$V_{DS}=V_{GS}$ , $I_D=-250\mu A$
Gate-Source Leakage Forward	$I_{GSS}$	ALL	—	—	-100	nA	$V_{GS}=-20V$
Gate-Source Leakage Reverse	$I_{GSS}$	ALL	—	—	100	nA	$V_{GS}=20V$
Zero Gate Voltage Drain Current	$I_{DSS}$	ALL	—	—	-250	$\mu A$	$V_{DS}=\text{Max. Rating}$ , $V_{GS}=0V$
			—	—	-1000	$\mu A$	$V_{DS}=\text{Max. Rating} \times 0.8$ , $V_{GS}=0V$ , $T_C=125^\circ\text{C}$
On-State Drain-Source Current (2)	$I_{D(on)}$	IRF9230/1 IRFP9230/1 IRF9630/1	-6.5	—	—	A	$V_{DS}>I_{D(on)} \times R_{DS(on) \text{ max.}}$ , $V_{GS}=-10V$
		IRF9232/3 IRFP9232/3 IRF9632/3	-5.5	—	—	A	
Static Drain-Source On-State Resistance (2)	$R_{DS(on)}$	IRF9230/1 IRFP9230/1 IRF9630/1	—	—	0.8	$\Omega$	$V_{GS}=-10V$ , $I_D=-3.5A$
		IRF9232/3 IRFP9232/3 IRF9632/3	—	—	1.2	$\Omega$	
Forward Transconductance (2)	$g_{fs}$	ALL	2.2	—	—	S	$V_{DS}>I_{D(on)} \times R_{DS(on) \text{ max.}}$ , $I_D=-3.5A$
Input Capacitance	$C_{iss}$	ALL	—	—	650	pF	$V_{GS}=0V$ , $V_{DS}=-25V$ , $f=1.0\text{MHz}$
Output Capacitance	$C_{oss}$	ALL	—	—	300	pF	
Reverse Transfer Capacitance	$C_{rss}$	ALL	—	—	90	pF	
Turn-On Delay Time	$t_{d(on)}$	ALL	—	—	50	ns	$V_{DD}=0.5BV_{DSS}$ , $I_D=-3.5A$ , $Z_o=50\Omega$ , (MOSFET switching times are essentially independent of operating temperature.)
Rise Time	$t_r$	ALL	—	—	100	ns	
Turn-Off Delay Time	$t_{d(off)}$	ALL	—	—	100	ns	
Fall Time	$t_f$	ALL	—	—	80	ns	$V_{GS}=-15V$ , $I_D=-8.0A$ , $V_{DS}=0.8 \text{ Max. Rating}$ (Gate charge is essentially independent of operating temperature.)
Total Gate Charge (Gate-Source Plus Gate-Drain)	$Q_g$	ALL	—	—	45	nC	
Gate-Source Charge	$Q_{gs}$	ALL	—	—	20	nC	
Gate-Drain ("Miller") Charge	$Q_{gd}$	ALL	—	—	25	nC	

## THERMAL RESISTANCE

Junction-to-Case	$R_{thJC}$	ALL	—	—	1.67	K/W	
Case-to-Sink	$R_{thCS}$	ALL	—	1.0	—	K/W	Mounting surface flat, smooth, and greased
Junction-to-Ambient	$R_{thJA}$	IRFPXXXX IRF96XX	—	—	80	K/W	Free Air Operation
		IRF92XX	—	—	30	K/W	

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



SAMSUNG SEMICONDUCTOR



IRF9230/9231/9232/9233  
IRFP9230/9231/9232/9233  
IRF9630/9631/9632/9633

78 DE 7964142 0005419 7

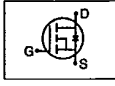
P-CHANNEL  
POWER MOSFETS

7964142 SAMSUNG SEMICONDUCTOR INC

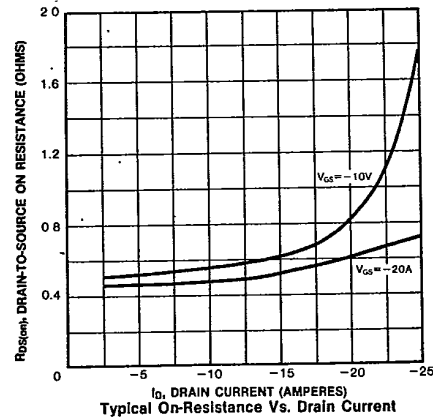
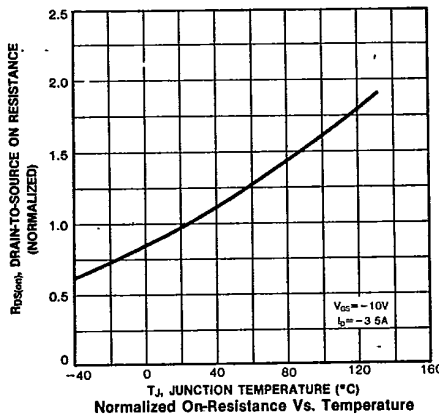
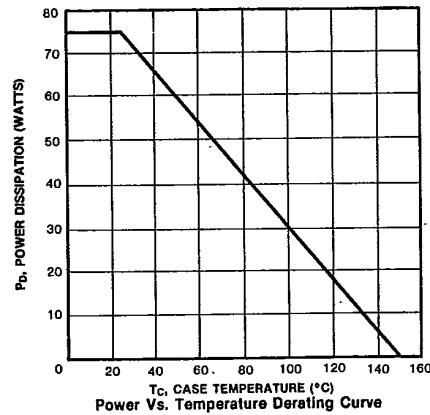
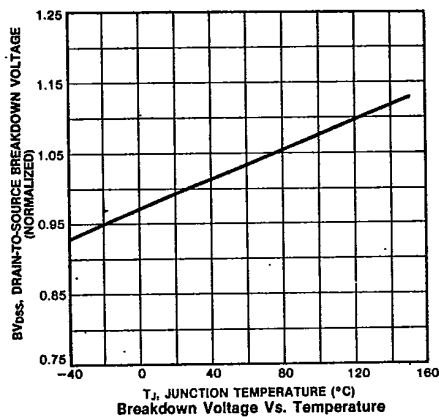
98D 05419 D

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

T-39-21

Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Continuous Source Current (Body Diode)	$I_S$	IRF9230/1 IRFP9230/1 IRF9630/1	—	—	-6.5	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier 
		IRF9232/3 IRFP9232/3 IRF9632/3	—	—	-5.5	A	
Pulse Source Current (Body Diode) (3)	$I_{SM}$	IRF9230/1 IRFP9230/1 IRF9630/1	—	—	-26	A	
		IRF9232/3 IRFP9232/3 IRF9632/3	—	—	-22	A	
Diode Forward Voltage (2)	$V_{SD}$	IRF9230/1 IRFP9230/1 IRF9630/1	—	—	-6.5	V	$T_C=25^\circ\text{C}$ , $I_S=-6.5\text{A}$ , $V_{GS}=0\text{V}$
		IRF9232/3 IRFP9232/3 IRF9632/3	—	—	-6.3	V	$T_C=25^\circ\text{C}$ , $I_S=-5.5\text{A}$ , $V_{GS}=0\text{V}$
Reverse Recovery Time	$t_{rr}$	ALL	—	—	—	ns	$T_J=150^\circ\text{C}$ , $I_F=-6.5\text{A}$ , $dI_F/dt=100\text{A}/\mu\text{s}$

Notes: (1)  $T_J=25^\circ\text{C}$  to  $150^\circ\text{C}$  (2) Pulse test: Pulse width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$   
(3) Repetitive rating: Pulse width limited by max. junction temperature



IRF9240/9241/9242/9243

7964142 0005420 3

-39-23

IRFP9240/9241/9242/9243

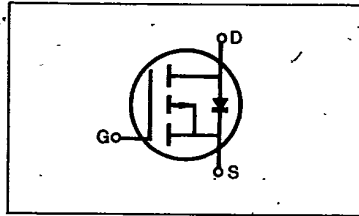
IRF9640/9641/9642/9643

POWER MOSFETS

## Preliminary Specifications

98 DE 7964142 0005420 3

-200 Volt, 0.5 Ohm SFET



## FEATURES

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

## PRODUCT SUMMARY

Part Number	$V_{DS}$	$R_{DS(on)}$	$I_D$
IRF/IRFP9240, IRF9640	-200V	0.5 $\Omega$	-11A
IRF/IRFP9241, IRF9641	-150V	0.5 $\Omega$	-11A
IRF/IRFP9242, IRF9642	-200V	0.7 $\Omega$	-9.0A
IRF/IRFP9243, IRF9643	-150V	0.7 $\Omega$	-9.0A

## PACKAGE STYLE

Package Type	Part Number
TO-3	IRF9240/9241/9242/9243
TO-3P	IRFP9240/9241/9242/9243
TO-220	IRF9640/9641/9642/9643

## MAXIMUM RATINGS

Characteristic	Symbol	IRF/IRFP				Unit
		9240 9640	9241 9641	9242 9642	9243 9643	
Drain-Source Voltage (1)	$V_{DSS}$	-200	-150	-200	-150	Vdc
Drain-Gate Voltage ( $R_{GS}=1.0M\Omega$ ) (1)	$V_{DGR}$	-200	-150	-200	-150	vac
Gate-Source Voltage	$V_{GS}$	$\pm 20$				Vdc
Continuous Drain Current $T_C=25^\circ C$	$I_D$	-11	-11	-9.0	-9.0	Adc
Continuous Drain Current $T_C=100^\circ C$	$I_D$	-7.0	-7.0	-6.0	-6.0	Adc
Drain Current—Pulsed (3)	$I_{DM}$	-44	-44	-36	-36	Adc
Gate Current—Pulsed	$I_{GM}$	$\pm 1.5$				Adc
Total Power Dissipation @ $T_C=25^\circ C$	$P_D$	125				Watts
Derate above $25^\circ C$		1.0				W/ $^\circ C$
Operating and Storage Junction Temperature Rangy	$T_J, T_{stg}$	-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 width limited by max. junction temperature



SAMSUNG SEMICONDUCTOR

IRF9240/9241/9242/9243

IRFP9240/9241/9242/9243

IRF9640/9641/9642/9643

P-CHANNEL  
POWER MOSFETS

T-39-Q3

ELECTRICAL CHARACTERISTICS (T<sub>C</sub>=25°C unless otherwise specified)

Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	IRF9240/2 IRFP9240/2 IRF9640/2	-200	—	—	V	V <sub>GS</sub> =0V
		IRF9241/3 IRFP9241/3 IRF9641/3	-150	—	—	V	I <sub>D</sub> = -250μA
Gate Threshold Voltage	V <sub>GS(th)</sub>	ALL	-2.0	—	-4.0	V	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = -250μA
Gate-Source Leakage Forward	I <sub>GSS</sub>	ALL	—	—	-100	nA	V <sub>GS</sub> = -20V
Gate-Source Leakage Reverse	I <sub>GSS</sub>	ALL	—	—	100	nA	V <sub>GS</sub> = 20V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	ALL	—	—	-250	μA	V <sub>DS</sub> = Max. Rating, V <sub>GS</sub> = 0V
			—	—	-1000	μA	V <sub>DS</sub> = Max. Rating × 0.8, V <sub>GS</sub> = 0V, T <sub>C</sub> = 125°C
On-State Drain-Source Current (2)	I <sub>D(on)</sub>	IRF9240/1 IRFP9240/1 IRF9640/1	-11	—	—	A	V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)</sub> max., V <sub>GS</sub> = -10V
		IRF9642 IRF9643	-9.0	—	—	A	
Static Drain-Source On-State Resistance (2)	R <sub>DS(on)</sub>	IRF9240/1 IRFP9240/1 IRF9640/1	—	—	0.5	Ω	V <sub>GS</sub> = -10V, I <sub>D</sub> = -6.0A
		IRF9242/3 IRFP9242/3 IRF9642/3	—	—	0.7	Ω	
Forward Transconductance (2)	g <sub>fs</sub>	ALL	4.0	—	—	S	V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)</sub> max., I <sub>D</sub> = -6.0A
Input Capacitance	C <sub>iss</sub>	ALL	—	—	1300	pF	V <sub>GS</sub> = 0V, V <sub>DS</sub> = -25V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	ALL	—	—	450	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	ALL	—	—	250	pF	
Turn-On Delay Time	t <sub>d(on)</sub>	ALL	—	—	30	ns	V <sub>DD</sub> = 0.5BV <sub>DSS</sub> , I <sub>D</sub> = -6.0A, Z <sub>Θ</sub> = 4.7Ω, (MOSFET switching times are essentially independent of operating temperature.)
Rise Time	t <sub>r</sub>	ALL	—	—	15	ns	
Turn-Off Delay Time	t <sub>d(off)</sub>	ALL	—	—	18	ns	
Fall Time	t <sub>f</sub>	ALL	—	—	12	ns	
Total Gate Charge (Gate-Source Plus Gate-Drain)	Q <sub>g</sub>	ALL	—	—	90	nC	V <sub>GS</sub> = -15V, I <sub>D</sub> = -22A, V <sub>DS</sub> = 0.8 Max. Rating (Gate charge is essentially independent of operating temperature.)
Gate-Source Charge	Q <sub>gs</sub>	ALL	—	—	30	nC	
Gate-Drain ("Miller") Charge	Q <sub>gd</sub>	ALL	—	—	60	nC	

## THERMAL RESISTANCE

Junction-to-Case	R <sub>thJC</sub>	ALL	—	—	1.0	K/W	
Case-to-Sink	R <sub>thCS</sub>	ALL	—	1.0	—	K/W	Mounting surface flat, smooth, and greased
Junction-to-Ambient	R <sub>thJA</sub>	IRFPXXX IRF96XX	—	—	80		Free Air Operation
		IRF92XX	—	—	.30	K/W	

Notes: (1) T<sub>J</sub> = 25°C to 150°C

(2) Pulse test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%

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



SAMSUNG SEMICONDUCTOR

IRF9240/9241/9242/9243

7964142 0005422 7

T-39-a3

IRFP9240/9241/9242/9243

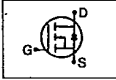
P-CHANNEL

IRF9640/9641/9642/9643

POWER MOSFETS

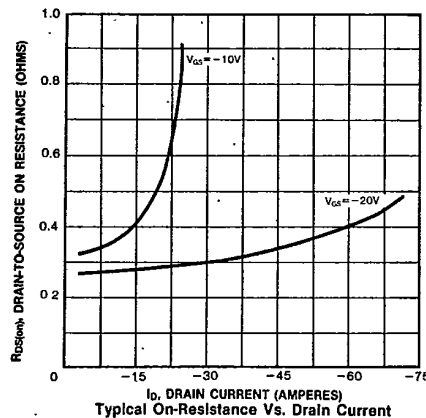
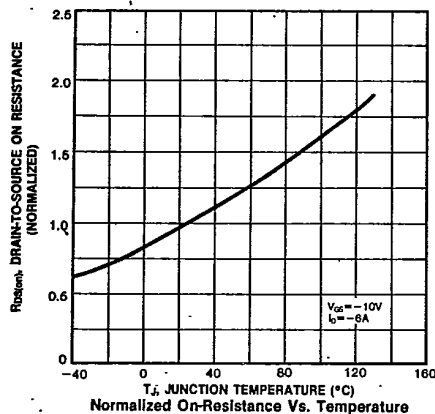
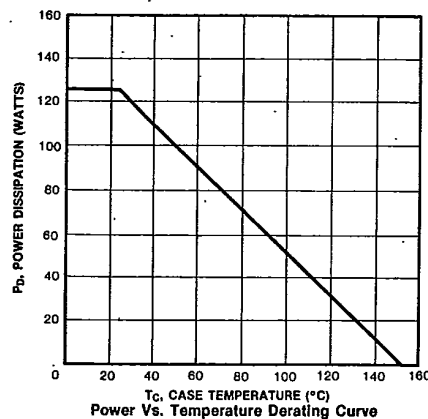
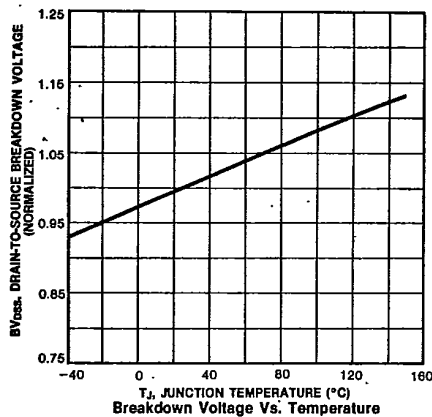
98 DE 7964142 0005422 7

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Continuous Source Current (Body Diode)	$I_S$	IRF9240/1 IRFP9240/1 IRF9640/1	—	—	-11	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier 
		IRF9242/3 IRFP9242/3 IRF9642/3	—	—	-9.0	A	
		IRF9240/1 IRFP9240/1 IRF9640/1	—	—	-44	A	
Pulse Source Current (Body Diode) (3)	$I_{SM}$	IRF9240/1 IRFP9240/1 IRF9640/1	—	—	-44	A	$T_C = 25^\circ\text{C}$ , $I_S = -11\text{A}$ , $V_{GS} = 0\text{V}$
		IRF9242/3 IRFP9242/3 IRF9642/3	—	—	-36	A	
		IRF9240/1 IRFP9240/1 IRF9640/1	—	—	-4.6	V	
Diode Forward Voltage (2)	$V_{SD}$	IRF9240/1 IRFP9240/1 IRF9640/1	—	—	-4.6	V	$T_C = 25^\circ\text{C}$ , $I_S = -9.0\text{A}$ , $V_{GS} = 0\text{V}$
		IRF9242/3 IRFP9242/3 IRF9642/3	—	—	-4.4	V	
		IRF9240/1 IRFP9240/1 IRF9640/1	—	—	-4.6	V	
Reverse Recovery Time	$t_{rr}$	ALL	—	—	—	ns	$T_J = 150^\circ\text{C}$ , $I_F = -11\text{A}$ , $dI_F/dt = 100\text{A}/\mu\text{s}$

Notes: (1)  $T_J = 25^\circ\text{C}$  to  $150^\circ\text{C}$  (2) Pulse test: Pulse width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ 

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



SAMSUNG SEMICONDUCTOR