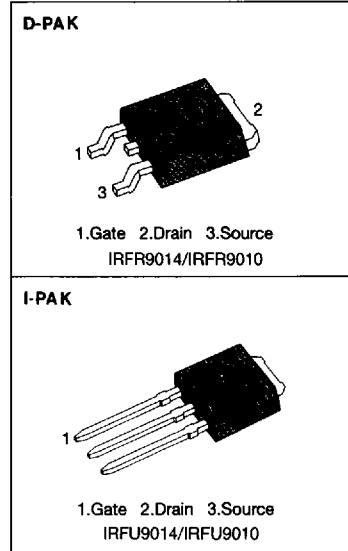


**FEATURES**

- 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 <sub>DS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
IRFR9014/U9014	-60V	0.50 $\Omega$	-5.3A
IRFR9010/U9010	-50V	0.50 $\Omega$	-5.3A



**ABSOLUTE MAXIMUM RATINGS**

Characteristic	Symbol	IRFR9014/U9014	IRFR9010/U9010	Unit
Drain-Source Voltage (1)	V <sub>DSS</sub>	-60	-50	Vdc
Drain-Gate Voltage (R <sub>GS</sub> =1.0M $\Omega$ )(1)	V <sub>DGR</sub>	-60	-50	Vdc
Gate-Source Voltage	V <sub>GS</sub>	$\pm 20$		Vdc
Continuous Drain Current T <sub>c</sub> =25 °C	I <sub>D</sub>	-5.3		Adc
Continuous Drain Current T <sub>c</sub> =100 °C	I <sub>D</sub>	-3.3		Adc
Drain Current - Pulsed (3)	I <sub>DM</sub>	-21		Adc
Gate Current - Pulsed	I <sub>GM</sub>	$\pm 1.5$		Adc
Single Pulsed Avalanche Energy (4)	E <sub>AS</sub>	240		mJ
Avalanche Current	I <sub>AS</sub>	-5.3		A
Total Power Dissipation at T <sub>c</sub> =25 °C	P <sub>D</sub>	25		Watts
Derate above 25 °C		0.20		
Operating and Storage Junction Temperature Range	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  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$

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

(4) L=9.7mH, V<sub>dd</sub>=-25V, R<sub>G</sub>=25  $\Omega$ , Starting T<sub>J</sub>=25°C



**ELECTRICAL CHARACTERISTICS** (Tc=25°C unless otherwise specified)

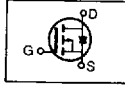
Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage					
	IRFR9014/IRFU9014	-60	-	-	V	V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA
	IRFR9010/IRFU9010	-50	-	-	V	
V <sub>GS(th)</sub>	Gate Threshold Voltage	-2.0	-	-4.0	V	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA
I <sub>GSS</sub>	Gate-Source Leakage Forward	-	-	-100	nA	V <sub>GS</sub> =-20V
I <sub>GSS</sub>	Gate-Source Leakage Reverse	-	-	100	nA	V <sub>GS</sub> =20V
I <sub>OSS</sub>	Zero Gate Voltage Drain Current	-	-	-250	μA	V <sub>DS</sub> =-Max. Rating, V <sub>GS</sub> =0V
		-	-	-1000	μA	V <sub>DS</sub> =-0.8 Max. Rating, V <sub>GS</sub> =0V, Tc=125°C
R <sub>DS(on)</sub>	Static Drain-Source On-State Resistance (2)	-	-	0.50	Ω	V <sub>GS</sub> =-10V, I <sub>D</sub> =-2.7A
g <sub>fs</sub>	Forward Transconductance (2)	1.1	-	-	Ω	V <sub>DS</sub> ≥ -50V, I <sub>D</sub> =-2.7A
C <sub>iss</sub>	Input Capacitance	-	308	-	pF	V <sub>GS</sub> =0V
C <sub>oss</sub>	Output Capacitance	-	123	-	pF	V <sub>DS</sub> =-25V
C <sub>rss</sub>	Reverse Transfer Capacitance	-	55	-	pF	f=1.0MHz
t <sub>d(on)</sub>	Turn-On Delay Time	-	-	9.2	ns	(MOSFET switching times are essentially independent of operating temperature)
t <sub>r</sub>	Rise Time	-	-	71	ns	
t <sub>d(off)</sub>	Turn-Off Delay Time	-	-	20	ns	
t <sub>f</sub>	Fall Time	-	-	59	ns	
Q <sub>g</sub>	Total Gate Charge (Gate-Source Plus Gate-Drain)	-	-	17.5	nC	
Q <sub>gs</sub>	Gate-Source Charge	-	4.6	-	nC	V <sub>GS</sub> =-10V, I <sub>D</sub> =-5.3A, V <sub>DS</sub> =0.8 Max. Rating (Gate charge is essentially independent of operating temperature)
Q <sub>gd</sub>	Gate-Drain ("Miller") Charge	-	6.1	-	nC	

**THERMAL RESISTANCE**

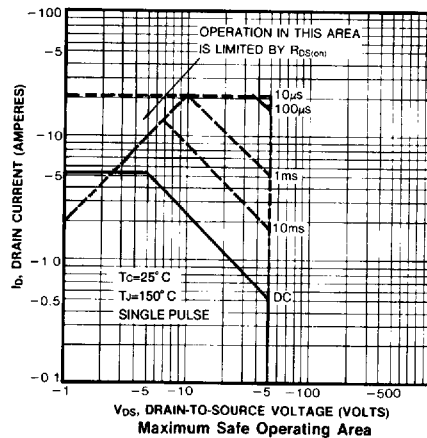
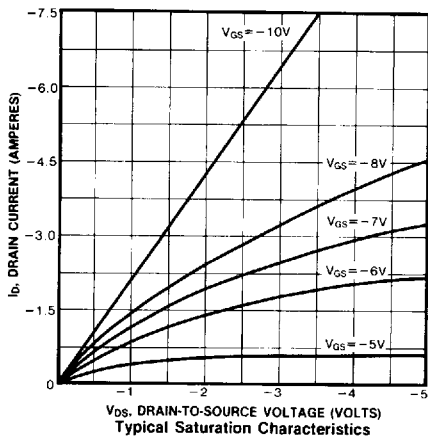
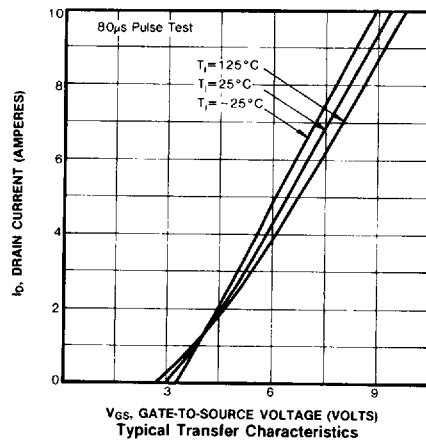
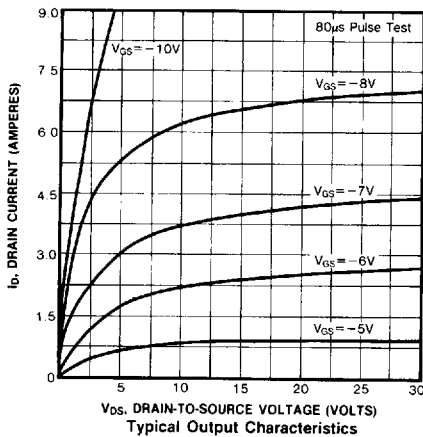
Symbol	Characteristics		All	Units	Remark
R <sub>thJC</sub>	Junction-to-Case	MAX	5.0	K/W	
R <sub>thCS</sub>	Case-to-Sink	TYP	1.7	K/W	Mounting surface flat, smooth and greased
R <sub>thJA</sub>	Junction-to-Ambient	MAX	110	K/W	Free Air Operation

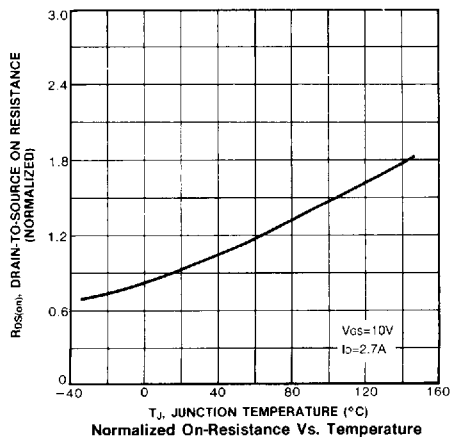
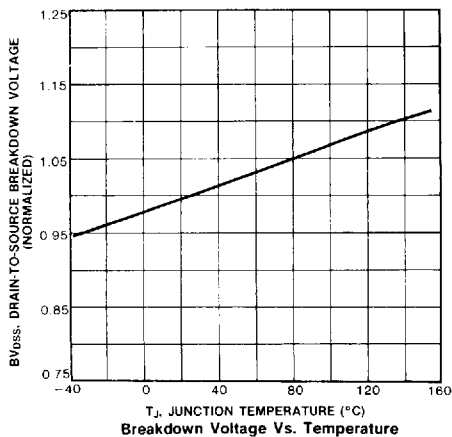
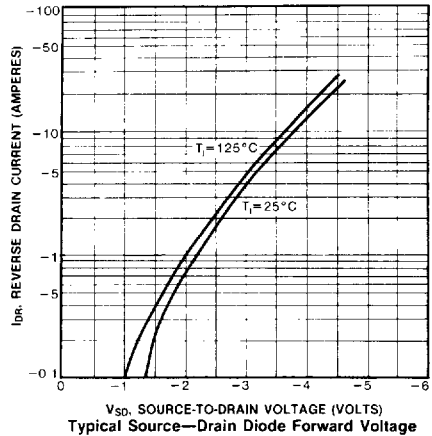
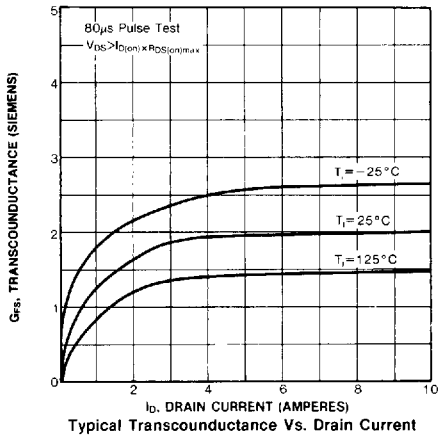
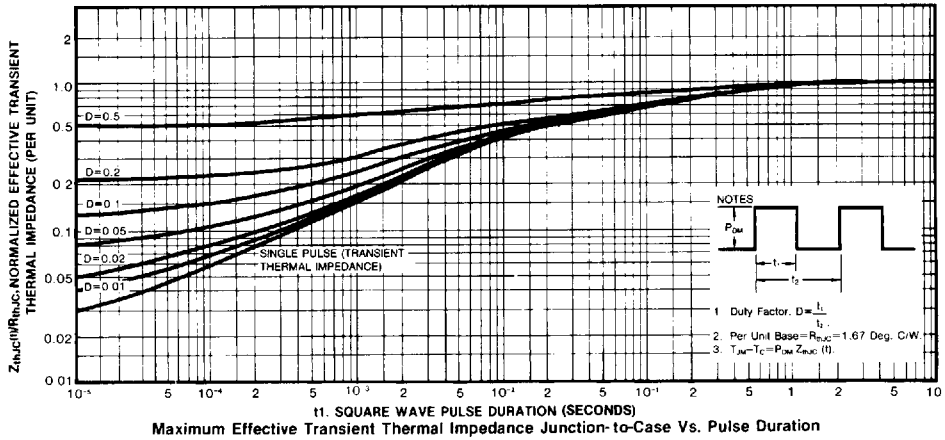
- Notes : (1) T<sub>J</sub>=25°C to 150°C  
 (2) Pulse test : Pulse width ≤ 300μs, Duty Cycle ≤ 2%  
 (3) Repetitive rating : Pulse width limited by max. junction temperature

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions
$I_S$	Continuous Source Current (Body Diode)	-	-	-5.3	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier 
$I_{SM}$	Pulse Source Current (Body Diode) (3)	-	-	-21	A	
$V_{SD}$	Diode Forward Voltage	-	-	-5.5	V	$T_J=25^\circ\text{C}$ , $I_S=-5.3\text{A}$ , $V_{GS}=0\text{V}$
$t_{rr}$	Reverse Recovery Time	-	-	160	ns	$T_J=25^\circ\text{C}$ , $I_F=-5.3\text{A}$ , $dI_F/dt=100\text{A}/\mu\text{S}$

- 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





4

