

IRFP240R, IRFP241R
IRFP242R, IRFP243R
File Number **2087**

Avalanche Energy Rated N-Channel Power MOSFETs

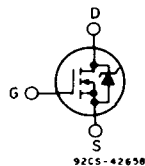
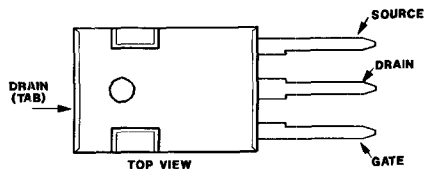
16A and 18A, 200V, 150V
 $r_{DS(on)} = 0.18\Omega$ and 0.22Ω

Features:

- Single pulse avalanche energy rated
- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance

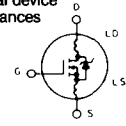
The IRFP240R, IRFP241R, IRFP242R and IRFP243R are advanced power MOSFETs designed, tested, and guaranteed to withstand a specified level of energy in the breakdown avalanche mode of operation. These are n-channel enhancement-mode silicon-gate power field-effect transistors designed for applications such as switching regulators, switching converters, motor drivers, relay drivers, and drivers for high-power bipolar switching transistors requiring high speed and low gate-drive power. These types can be operated directly from integrated circuits.

The IRFP-types are supplied in the JEDEC TO-247 plastic package.

N-CHANNEL ENHANCEMENT MODE**TERMINAL DIAGRAM****TERMINAL DESIGNATION****JEDEC TO-247****Absolute Maximum Ratings**

Parameter		IRFP240R	IRFP241R	IRFP242R	IRFP243R	Units
V_{DS}	Drain - Source Voltage ①	200	150	200	150	V
V_{DGR}	Drain - Gate Voltage ($R_{GS} = 20\text{ K}\Omega$) ①	200	150	200	150	V
$I_D @ T_c = 25^\circ\text{C}$	Continuous Drain Current	18	18	16	16	A
$I_D @ T_c = 100^\circ\text{C}$	Continuous Drain Current	11	11	10	10	A
I_{DM}	Pulsed Drain Current ③	72	72	64	64	A
V_{GS}	Gate - Source Voltage	± 20				V
$P_D @ T_c = 25^\circ\text{C}$	Max. Power Dissipation	125 (See Fig. 14)				W
	Linear Derating Factor	1.0 (See Fig. 14)				W/ $^\circ\text{C}$
E_{AS}	Single Pulse Avalanche Energy Rating ④	510				mJ
T_J	Operating Junction and Storage Temperature Range	-55 to 150				$^\circ\text{C}$
T_{stg}	Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				$^\circ\text{C}$

Electrical Characteristics @ $T_C = 25^\circ\text{C}$ (Unless Otherwise Specified)

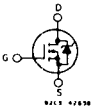
Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions	
BV _{DSS} Drain - Source Breakdown Voltage	IRFP240R IRFP242R	200	—	—	V	V _{GS} = 0V	
	IRFP241R IRFP243R	150	—	—	V	I _D = 250 μ A	
	ALL	2.0	—	4.0	V	V _{DS} = V _{GS} , I _D = 250 μ A	
V _{GS(th)} Gate Threshold Voltage	ALL	—	—	100	nA	V _{GS} = 20V	
I _{GSS} Gate-Source Leakage Forward	ALL	—	—	-100	nA	V _{GS} = -20V	
I _{GSS} Gate-Source Leakage Reverse	ALL	—	—	250	μ A	V _{DS} = Max. Rating, V _{GS} = 0V	
I _{DSS} Zero Gate Voltage Drain Current	ALL	—	—	1000	μ A	V _{DS} = Max. Rating x 0.8, V _{GS} = 0V, T _C = 125°C	
I _{D(on)} On-State Drain Current ②	IRFP240R IRFP241R	18	—	—	A	V _{DS} > I _{D(on)} x R _{DS(on)max} , V _{GS} = 10V	
	IRFP242R IRFP243R	16	—	—	A		
	ALL	—	0.14	0.18	Ω		
R _{DS(on)} Static Drain-Source On-State Resistance ②	IRFP240R IRFP241R	—	0.14	0.18	Ω	V _{GS} = 10V, I _D = 10A	
	IRFP242R IRFP243R	—	0.20	0.22	Ω		
	ALL	6.0	9.0	—	S(Ω)		
g _{fs} Forward Transconductance ②	ALL	—	1275	—	pF	V _{GS} = 0V, V _{DS} = 25V, f = 1.0 MHz	
C _{iss} Input Capacitance	ALL	—	500	—	pF	See Fig. 10	
C _{oss} Output Capacitance	ALL	—	160	—	pF		
C _{rss} Reverse Transfer Capacitance	ALL	—	16	30	ns	V _{DD} $\approx$ 75V, I _D = 10A, Z ₀ = 4.7 Ω	
t _{d(on)} Turn-On Delay Time	ALL	—	27	60	ns		
t _r Rise Time	ALL	—	40	80	ns	See Fig. 17 (MOSFET switching times are essentially independent of operating temperature.)	
t _{d(off)} Turn-Off Delay Time	ALL	—	31	60	ns		
t _f Fall Time	ALL	—	43	60	nC	V _{GS} = 10V, I _D = 22A, V _{DS} = 0.8 Max. Rating. See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)	
Q _g Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	16	—	nC		
Q _{gs} Gate-Source Charge	ALL	—	27	—	nC		
Q _{gd} Gate-Drain ("Miller") Charge	ALL	—	5.0	—	nH	Measured between the contact screw on header that is closer to source and gate pins and center of die.	Modified MOSFET symbol showing the internal device inductances 
L _D Internal Drain Inductance	ALL	—	12.5	—	nH		
L _S Internal Source Inductance	ALL	—	—	—	nH	Measured from the source pin, 6 mm (0.25 in.) from header and source bonding pad.	

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Thermal Resistance

R _{thJC} Junction-to-Case	ALL	—	—	1.0	°C/W	
R _{thCS} Case-to-Sink	ALL	—	0.1	—	°C/W	Mounting surface flat, smooth, and greased.
R _{thJA} Junction-to-Ambient	ALL	—	—	30	°C/W	Free Air Operation

Source-Drain Diode Ratings and Characteristics

I _S Continuous Source Current (Body Diode)	IRFP240R IRFP241R	—	—	18	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier. 
	IRFP242R IRFP243R	—	—	16	A	
	ALL	—	—	—	—	
I _{SM} Pulse Source Current (Body Diode) ③	IRFP240R IRFP241R	—	—	72	A	
	IRFP242R IRFP243R	—	—	64	A	
	ALL	—	—	—	—	
V _{SD} Diode Forward Voltage ②	IRFP240R IRFP241R	—	—	2.0	V	T _C = 25°C, I _S = 18A, V _{GS} = 0V
	IRFP242R IRFP243R	—	—	1.9	V	
	ALL	—	—	—	—	
t _{rr} Reverse Recovery Time	ALL	—	650	—	ns	T _J = 150°C, I _F = 18A, dI _F /dt = 100A/ μ s
Q _{RR} Reverse Recovered Charge	ALL	—	4.1	—	μ C	T _J = 150°C, I _F = 18A, dI _F /dt = 100A/ μ s
t _{on} Forward Turn-on Time	ALL	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by L _S + L _D .				

① T_J = 25°C to 150°C. ② Pulse Test: Pulse width $\leq$ 300 μ s, Duty Cycle $\leq$ 2%.

③ Repetitive Rating: Pulse width limited by max. junction temperature. See Transient Thermal Impedance Curve (Fig. 5).

④ V_{DD} = 50V, starting T_J = 25°C, L = 1.9 mH, R_{gs} = 50 Ω , I_{peak} = 20A. See figures 15, 16.

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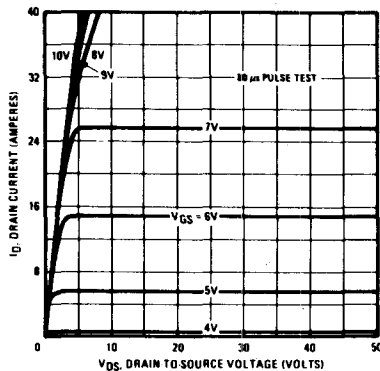


Fig. 1 - Typical output characteristics.

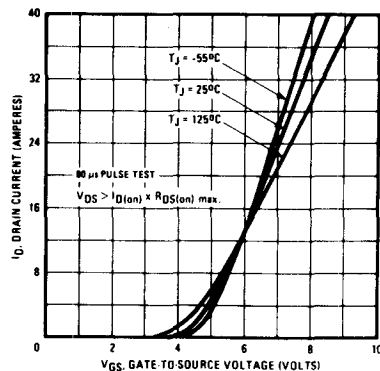


Fig. 2 - Typical transfer characteristics.

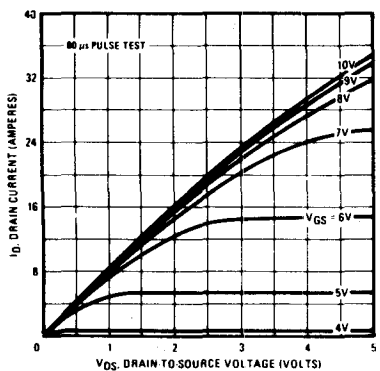


Fig. 3 - Typical saturation characteristics.

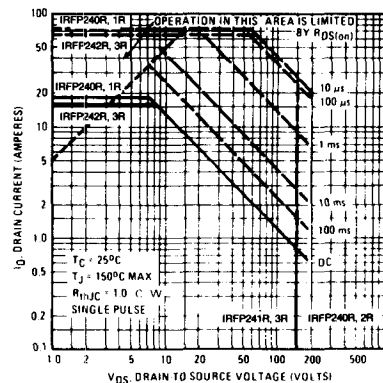


Fig. 4 - Maximum safe operating area.

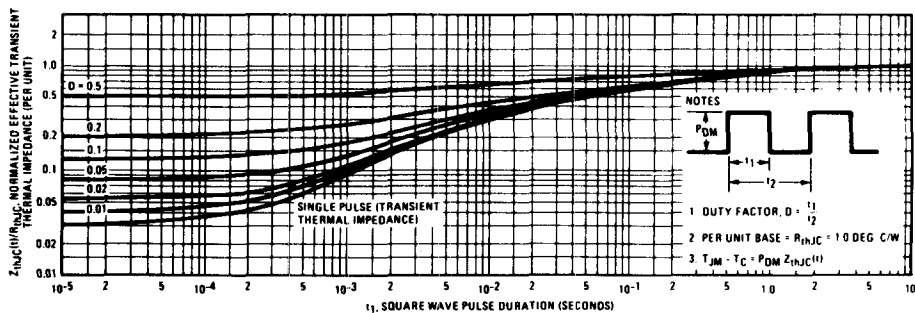


Fig. 5 - Maximum effective transient thermal impedance, junction-to-case vs. pulse duration.

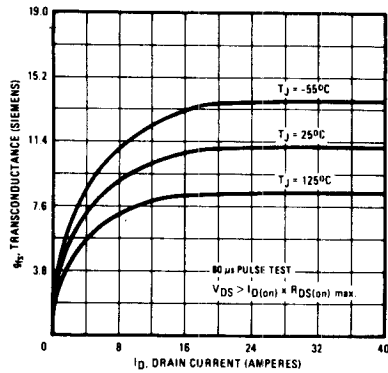


Fig. 6 - Typical transconductance vs. drain current.

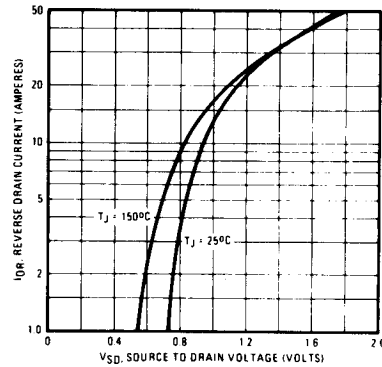


Fig. 7 - Typical source-drain diode forward voltage.

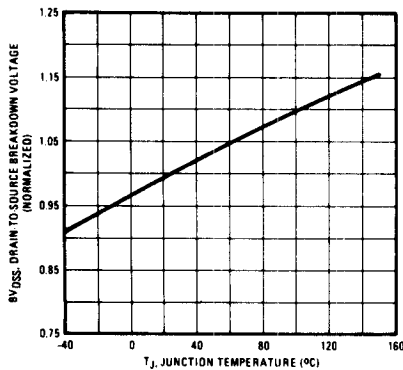


Fig. 8 - Breakdown voltage vs. temperature.

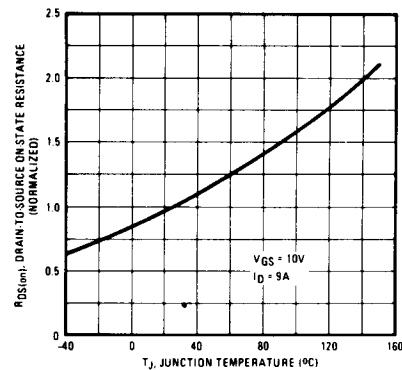


Fig. 9 - Normalized on-resistance vs. temperature.

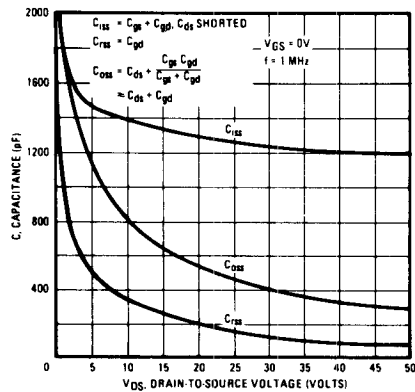


Fig. 10 - Typical capacitance vs. drain-to-source voltage.

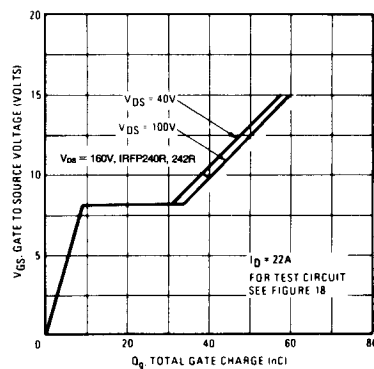


Fig. 11 - Typical gate charge vs. gate-to-source voltage.

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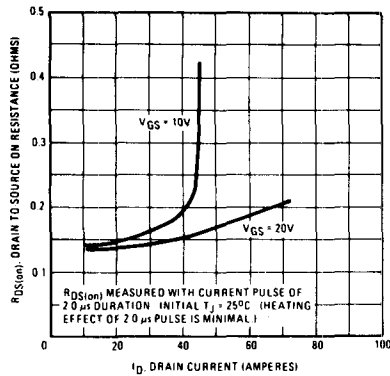


Fig. 12 - Typical on-resistance vs. drain current.

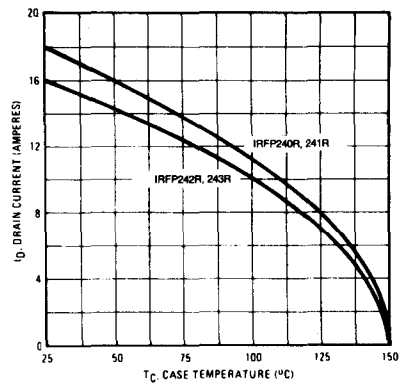


Fig. 13 - Maximum drain current vs. case temperature.

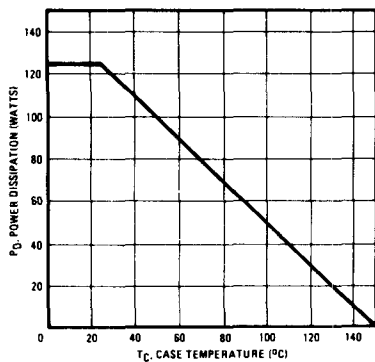


Fig. 14 - Power vs. temperature derating curve.

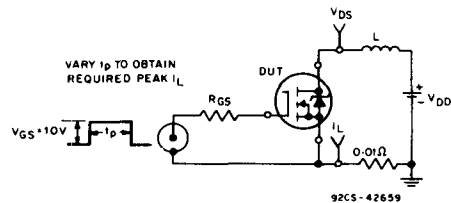


Fig. 15 - Unclamped energy test circuit.

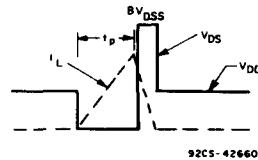


Fig. 16 - Unclamped energy waveforms.

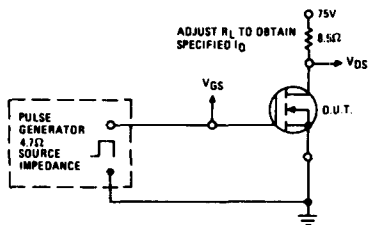


Fig. 17 - Switching time test circuit.

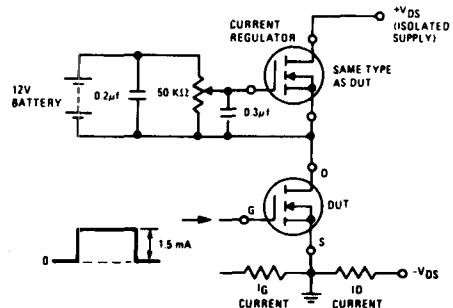


Fig. 18 - Gate charge test circuit.