

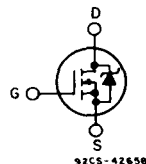
Avalanche Energy Rated N-Channel Power MOSFETs

25A and 30A, 150V-200V
 $r_{DS(on)} = 0.085\Omega$ and 0.120Ω

Features:

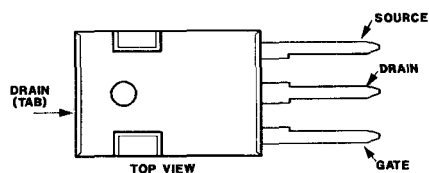
- Single pulse avalanche energy rated
- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance

N-CHANNEL ENHANCEMENT MODE



TERMINAL DIAGRAM

TERMINAL DESIGNATION



JEDEC TO-247

The IRFP250R, IRFP251R, IRFP252R and IRFP253R 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.

Absolute Maximum Ratings

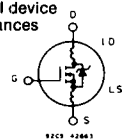
Parameter	IRFP250R	IRFP251R	IRFP252R	IRFP253R	Units
V_{DS} Drain - Source Voltage ①	200	150	200	150	V
V_{DGR} Drain - Gate Voltage ($R_{GS} = 20\text{ K}\Omega$) ①	200	150	200	150	V
I_D @ $T_C = 25^\circ\text{C}$ Continuous Drain Current	30	30	25	25	A
I_D @ $T_C = 100^\circ\text{C}$ Continuous Drain Current	19	19	16	16	A
I_{DM} Pulsed Drain Current ③	120	120	100	100	A
V_{GS} Gate - Source Voltage	± 20				V
P_D @ $T_C = 25^\circ\text{C}$ Max. Power Dissipation	150 (See Fig. 14)				W
Linear Derating Factor	1.2 (See Fig. 14)				W/ $^\circ\text{C}$
E_{AS} Single Pulse Avalanche Energy Rating ④	810				mJ
T_J Operating Junction and T_{stg} Storage Temperature Range	-55 to 150				$^\circ\text{C}$
Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				$^\circ\text{C}$

IRFP250R, IRFP251R, IRFP252R, IRFP253R

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	IRFP250R IRFP252R	200	—	—	V	V _{GS} = 0V I _D = 250μA
	IRFP251R IRFP253R	150	—	—	V	
	ALL	2.0	—	4.0	V	
V _{GS(th)} Gate Threshold Voltage	ALL	—	—	100	nA	V _{DS} = V _{GS} , I _D = 250μA
I _{GSS} Gate-Source Leakage Forward	ALL	—	—	-100	nA	V _{GS} = 20V
I _{GSS} Gate-Source Leakage Reverse	ALL	—	—	250	μA	V _{GS} = -20V
I _{DSS} Zero Gate Voltage Drain Current	ALL	—	—	1000	μA	V _{DS} = Max. Rating, V _{GS} = 0V
		—	—	—	—	V _{DS} = Max. Rating x 0.8, V _{GS} = 0V, T _C = 125°C
I _{D(on)} On-State Drain Current ②	IRFP250R IRFP251R	30	—	—	A	V _{DS} > I _{D(on)} x R _{D(on)} max., V _{GS} = 10V
	IRFP252R IRFP253R	25	—	—	A	
	ALL	—	0.07	0.085	Ω	
R _{D(on)} Static Drain-Source On-State Resistance ②	IRFP250R IRFP251R	—	0.07	0.085	Ω	V _{GS} = 10V, I _D = 16A
	IRFP252R IRFP253R	—	0.09	0.120	Ω	
	ALL	8.0	14	—	S(Ω)	
g _{fs} Forward Transconductance ②	ALL	—	2000	—	pF	V _{DS} > I _{D(on)} x R _{D(on)} max., I _D = 16A
C _{iss} Input Capacitance	ALL	—	800	—	pF	V _{GS} = 0V, V _{DS} = 25V, f = 1.0 MHz
C _{oss} Output Capacitance	ALL	—	300	—	pF	See Fig. 10
C _{rss} Reverse Transfer Capacitance	ALL	—	—	35	ns	V _{DS} = 95V, I _D = 16A, Z ₀ = 4.7Ω
t _{d(on)} Turn-On Delay Time	ALL	—	—	100	ns	See Fig. 17
t _r Rise Time	ALL	—	—	125	ns	(MOSFET switching times are essentially independent of operating temperature.)
t _{d(off)} Turn-Off Delay Time	ALL	—	—	100	ns	
t _f Fall Time	ALL	—	—	—	nC	V _{GS} = 10V, I _D = 38A, V _{DS} = 0.8V 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	—	42	—	nC	
Q _{gs} Gate-Source Charge	ALL	—	—	—	nH	
Q _{gd} Gate-Drain ("Miller") Charge	ALL	—	—	—	nH	
L _D Internal Drain Inductance	ALL	—	5.0	—	nH	Measured between the contact screw on header that is closer to source and gate pins and center of die.
L _S Internal Source Inductance	ALL	—	12.5	—	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	—	—	0.83	°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)	IRFP250R IRFP251R	—	—	30	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
	IRFP252R IRFP253R	—	—	25	A	
	ALL	—	—	—	—	
I _{SM} Pulse Source Current (Body Diode) ③	IRFP250R IRFP251R	—	—	120	A	T _C = 25°C, I _S = 30A, V _{GS} = 0V
	IRFP252R IRFP253R	—	—	100	A	
	ALL	—	—	—	—	
V _{SD} Diode Forward Voltage ②	IRFP250R IRFP251R	—	—	2.0	V	T _C = 25°C, I _S = 25A, V _{GS} = 0V
	IRFP252R IRFP253R	—	—	1.8	V	T _C = 25°C, I _S = 25A, V _{GS} = 0V
t _{rr} Reverse Recovery Time	ALL	—	750	—	ns	T _J = 150°C, I _F = 30A, dI _F /dt = 100A/μs
Q _{RR} Reverse Recovered Charge	ALL	—	4.7	—	μC	T _J = 150°C, I _F = 30A, dI _F /dt = 100A/μs
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 ≤ 300μs, Duty Cycle ≤ 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 = 1.1 mH, R_{gs} = 50Ω, I_{peak} = 33A. See figures 15, 16.

IRFP250R, IRFP251R, IRFP252R, IRFP253R

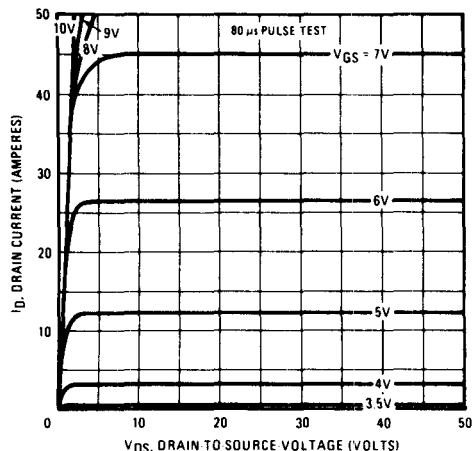


Fig. 1 – Typical Output Characteristics

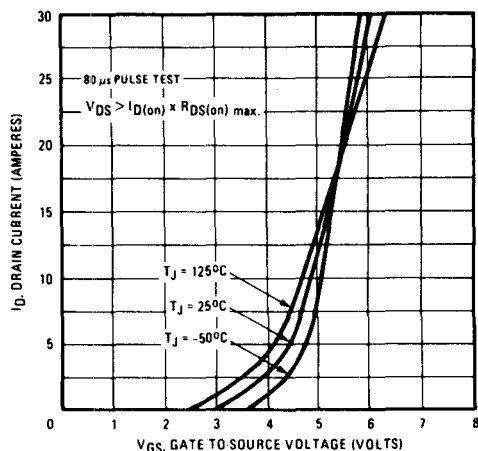


Fig. 2 – Typical Transfer Characteristics

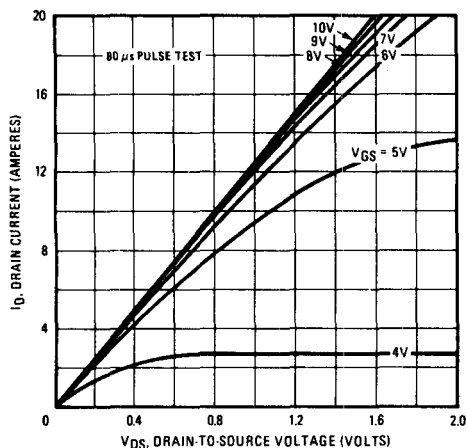


Fig. 3 – Typical Saturation Characteristics

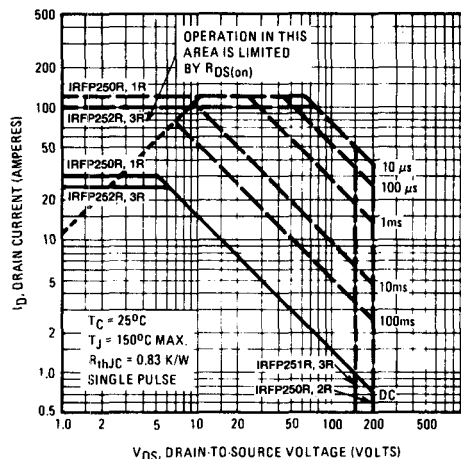


Fig. 4 – Maximum Safe Operating Area

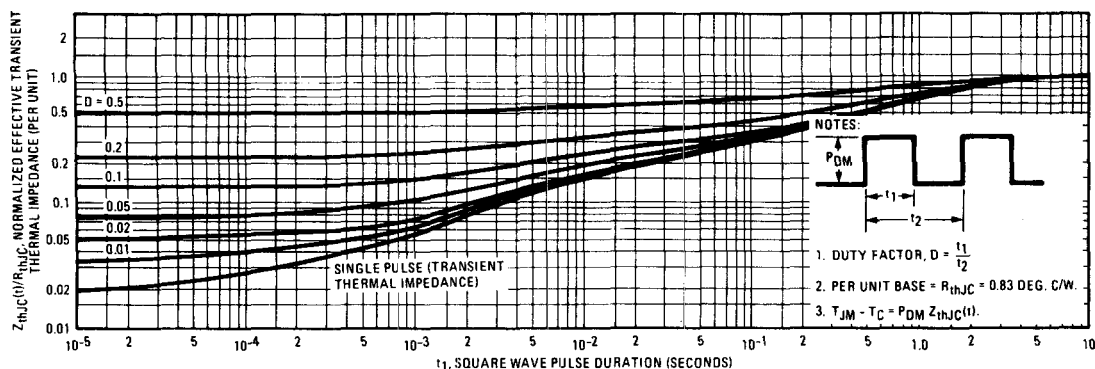


Fig. 5 – Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

IRFP250R, IRFP251R, IRFP252R, IRFP253R

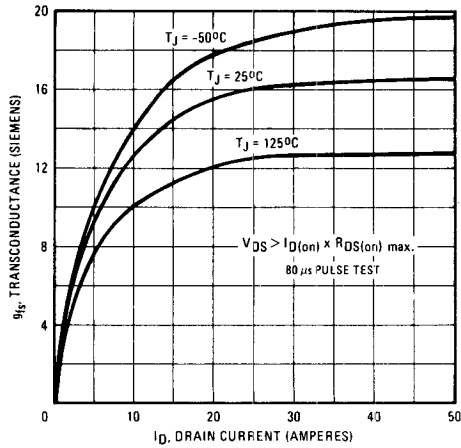


Fig. 6 – Typical Transconductance Vs. Drain Current

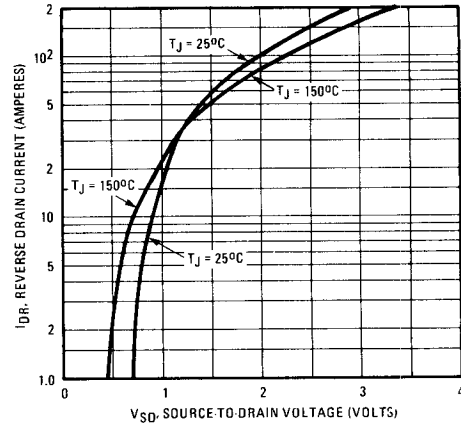


Fig. 7 – Typical Source-Drain Diode Forward Voltage

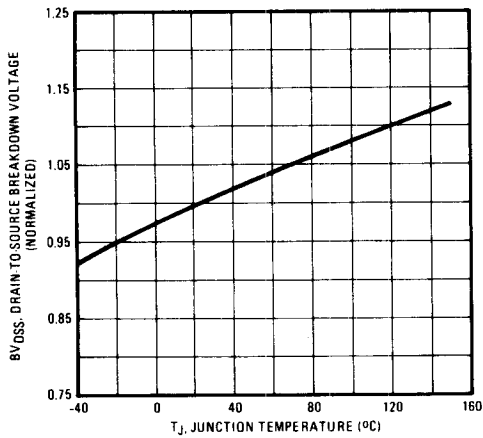


Fig. 8 – Breakdown Voltage Vs. Temperature

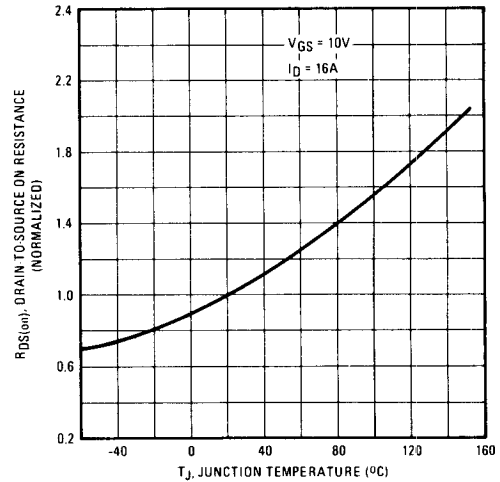


Fig. 9 – Normalized On-Resistance Vs. Temperature

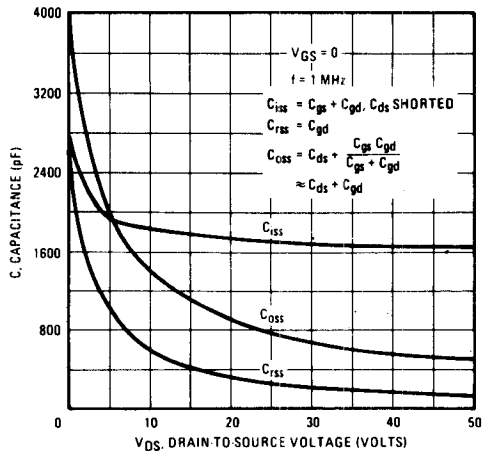


Fig. 10 – Typical Capacitance Vs. Drain-to-Source Voltage

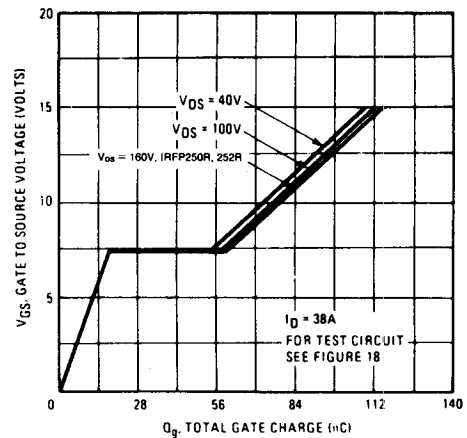


Fig. 11 – Typical Gate Charge Vs. Gate-to-Source Voltage

IRFP250R, IRFP251R, IRFP252R, IRFP253R

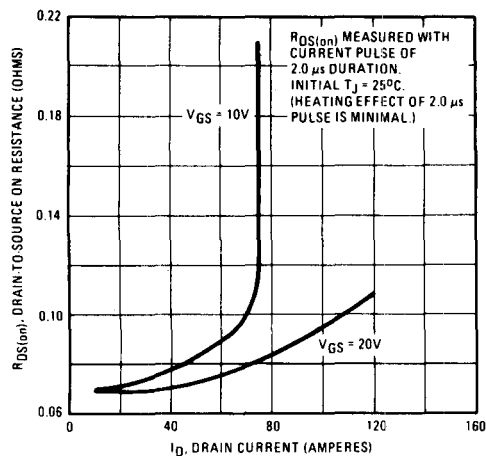


Fig. 12 – Typical On-Resistance Vs. Drain Current

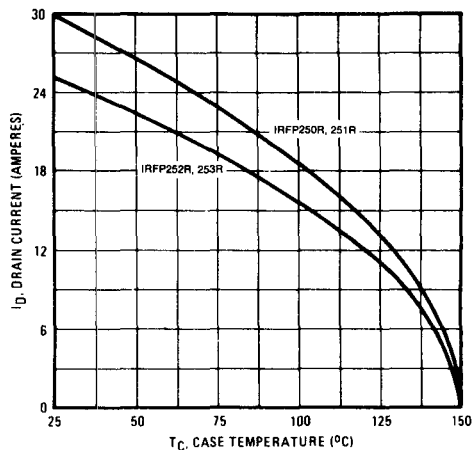


Fig. 13 – Maximum Drain Current Vs. Case Temperature

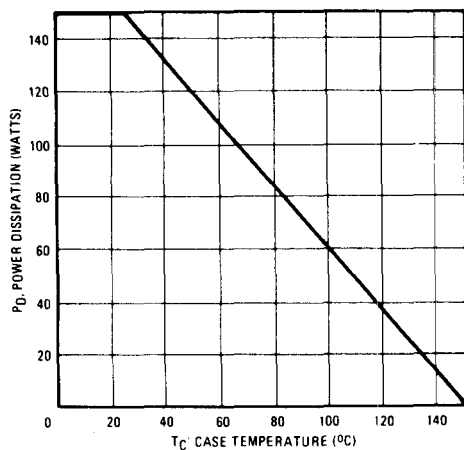


Fig. 14 – Power Vs. Temperature Derating Curve

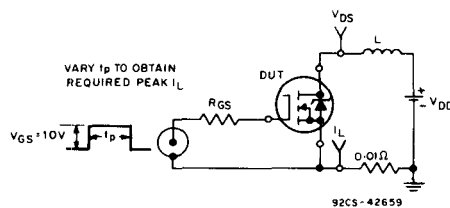


Fig. 15 – Unclamped Energy Test Circuit

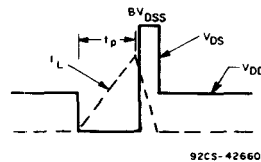


Fig. 16 – Unclamped Energy Waveforms

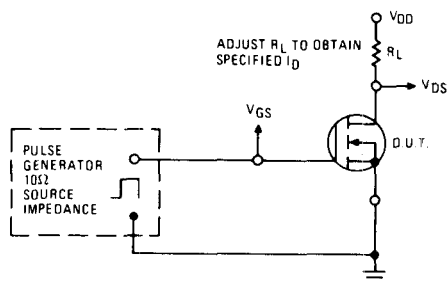


Fig. 17 – Switching Time Test Circuit

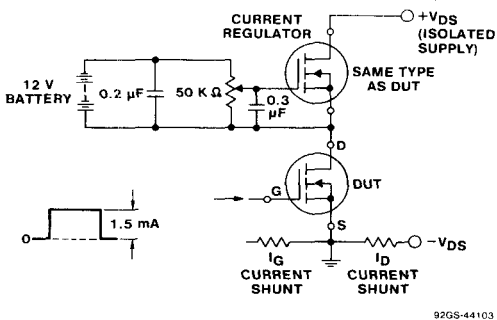


Fig. 18 – Gate Charge Test Circuit