

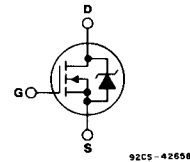
Avalanche-Energy-Rated N-Channel Power MOSFETs

22 A and 20 A, 275 V and 250 V
 $r_{DS(on)} = 0.14 \Omega$ and 0.17Ω

Features:

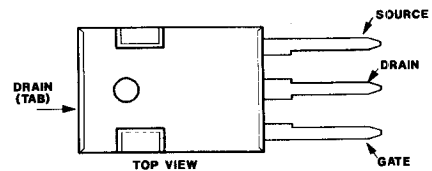
- Single pulse avalanche energy rated
- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance
- 275, 250 V dc rated - 120 V ac line system operation

N-CHANNEL ENHANCEMENT MODE



TERMINAL DIAGRAM

TERMINAL DESIGNATION



JEDEC TO-247

The IRFP254, IRFP255, IRFP256 and IRFP257 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.

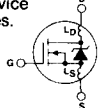
The IRFP-types are supplied in the JEDEC TO-247 plastic package.

ABSOLUTE-MAXIMUM RATINGS

CHARACTERISTIC	IRFP254	IRFP255	IRFP256	IRFP257	UNITS	
Drain-Source Voltage ①	V _{DS}	250	250	275	275	V
Drain-Gate Voltage (R _{GS} = 20 kΩ) ①	V _{DGR}	250	250	275	275	V
Continuous Drain Current	I _D @ T _C = 25°C	22	20	22	20	A
Continuous Drain Current	I _D @ T _C = 100°C	14	12	14	12	A
Pulsed Drain Current ②	I _{DM}	88	80	88	80	A
Gate-Source Voltage	V _{GS}	±20			V	
Maximum Power Dissipation	P _D @ T _C = 25°C	150			W	
Linear Derating Factor		1.2			W/°C	
Single-Pulse Avalanche Energy Rating ④	E _{as}	1000			mJ	
Operating Junction and Storage Temperature Range	T _J T _{stg}	-55 to +150			°C	
Lead Temperature		300 (0.063 in. [1.6 mm] from case for 10 s)			°C	

IRFP254, IRFP255, IRFP256, IRFP257

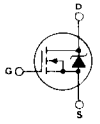
ELECTRICAL CHARACTERISTICS At Case Temperature (T_c) = 25°C Unless Otherwise Specified

CHARACTERISTIC	TYPE	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
Drain-Source Breakdown Voltage BV_{DSS}	IRFP256 IRFP257	275	—	—	V	$V_{GS} = 0$ V	$I_D = 250$ μ A
	IRFP254 IRFP255	250	—	—	V		
Gate Threshold Voltage $V_{GS(th)}$	ALL	2.0	—	4.0	V	$V_{DS} = V_{GS}$, $I_D = 250$ μ A	
Gate-Source Leakage Forward I_{GSS}	ALL	—	—	100	nA	$V_{GS} = 20$ V	
Gate-Source Leakage Reverse I_{GSS}	ALL	—	—	-100	nA	$V_{GS} = 20$ V	
Zero-Gate Voltage Drain Current I_{DSS}	ALL	—	—	250	μ A	$V_{DS} = \text{Max. Rating}$, $V_{GS} = 0$ V	$V_{DS} = \text{Max. Rating} \times 0.8$, $V_{GS} = 0$ V, $T_c = 125^\circ\text{C}$
		—	—	1000	μ A		
On-State Drain Current ② $I_{D(on)}$	IRFP254 IRFP256	22	—	—	A	$V_{DS} > I_{D(on)} \times r_{DS(on) \text{ max.}}$, $V_{GS} = 10$ V	
	IRFP255 IRFP257	20	—	—	A		
Static Drain-Source On-State Resistance ② $r_{DS(on)}$	IRFP254 IRFP256	—	0.11	0.14	Ω	$V_{GS} = 10$ V, $I_D = 12$ A	
	IRFP255 IRFP257	—	0.14	0.17	Ω		
Forward Transconductance ② g_{fs}	ALL	11	17	—	S(Ω)	$V_{DS} > I_{D(on)} \times r_{DS(on) \text{ max.}}$, $I_D = 12$ A	
Input Capacitance C_{iss}	ALL	—	2700	—	pF	$V_{GS} = 0$ V, $V_{DS} = 25$ V, $f = 1.0$ MHz	
Output Capacitance C_{oss}	ALL	—	580	—	pF	See Fig. 10	
Reverse Transfer Capacitance C_{rss}	ALL	—	130	—	pF		
Turn-On Delay Time $t_{d(on)}$	ALL	—	19	29	ns	$V_{DD} = 125$ V, $I_D = 22$ A, $Z_o = 6.2$ Ω See Fig. 16 (MOSFET switching times are essentially independent of operating temperature.)	
Rise Time t_r	ALL	—	84	130	ns		
Turn-Off Delay Time $t_{d(off)}$	ALL	—	75	110	ns		
Fall Time t_f	ALL	—	65	98	ns		
Total Gate Charge (Gate-Source Plus Gate-Drain) Q_g	ALL	—	87	130	nC	$V_{GS} = 10$ V, $I_D = 22$ A, $V_{DS} = 0.8$ Max. Rating. See Fig. 17 for test circuit. (Gate charge is essentially independent of operating temperature.)	
Gate-Source Charge Q_{gs}	ALL	—	14	20	nC		
Gate-Drain ("Miller") Charge Q_{gd}	ALL	—	73	110	nC		
Internal Drain Inductance L_D	ALL	—	5	—	nH		
Internal Source Inductance L_S	ALL	—	13	—	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad.	Modified MOSFET symbol showing the internal device inductances. 

THERMAL RESISTANCE

Junction-to-Case $R_{\theta JC}$	ALL	—	—	0.83	$^\circ\text{C/W}$	
Case-to-Sink $R_{\theta CS}$	ALL	—	0.12	—	$^\circ\text{C/W}$	Mounting surface flat, smooth, and greased.
Junction-to-Ambient $R_{\theta JA}$	ALL	—	—	30	$^\circ\text{C/W}$	Free air operation.

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Continuous Source Current (Body Diode) I_S	IRFP254 IRFP256	—	—	22	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier. 
	IRFP255 IRFP257	—	—	22	A	
Pulse Source Current (Body Diode) ③ I_{SM}	IRFP254 IRFP256	—	—	88	A	
	IRFP255 IRFP257	—	—	88	A	
Diode Forward Voltage ② V_{SD}	ALL	—	—	1.8	V	$T_c = 25^\circ\text{C}$, $I_S = 22$ A, $V_{GS} = 0$ V
Reverse Recovery Time t_{rr}	ALL	150	310	650	ns	$T_J = 150^\circ\text{C}$, $I_F = 22$ A, $dI_F/dt = 100$ A/ μ s
Reverse Recovered Charge Q_{RR}	ALL	1.9	4	8.4	μ C	$T_J = 150^\circ\text{C}$, $I_F = 22$ A, $dI_F/dt = 100$ A/ μ s
Forward Turn-on Time t_{on}	ALL	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by $L_S + L_D$.				

① $T_J = 25^\circ\text{C}$ to 150°C .② Pulse Test: Pulse width ≤ 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 $V_{DD} = 50$ V, Starting $T_J = 25^\circ\text{C}$, $L = 3.3$ mH,
 $R_G = 25$ Ω , Peak $I_L = 22$ A (See Figs. 14 & 15).

IRFP254, IRFP255, IRFP256, IRFP257

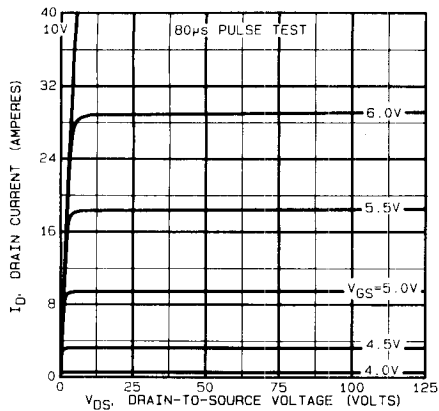


Fig. 1 - Typical output characteristics.

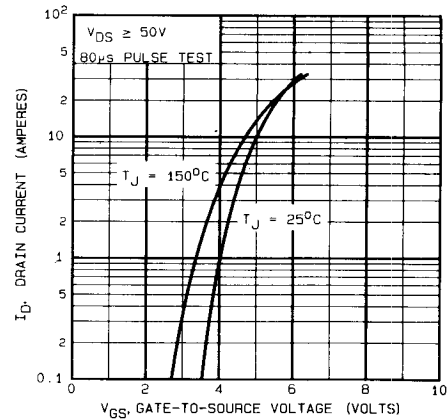


Fig. 2 - Typical transfer characteristics.

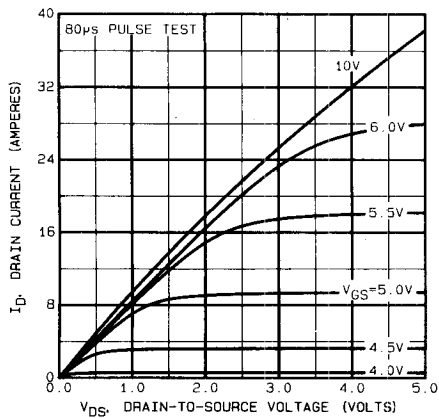


Fig. 3 - Typical saturation characteristics.

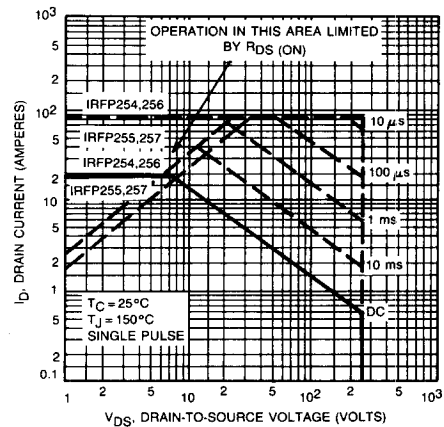


Fig. 4 - Maximum safe operating area.

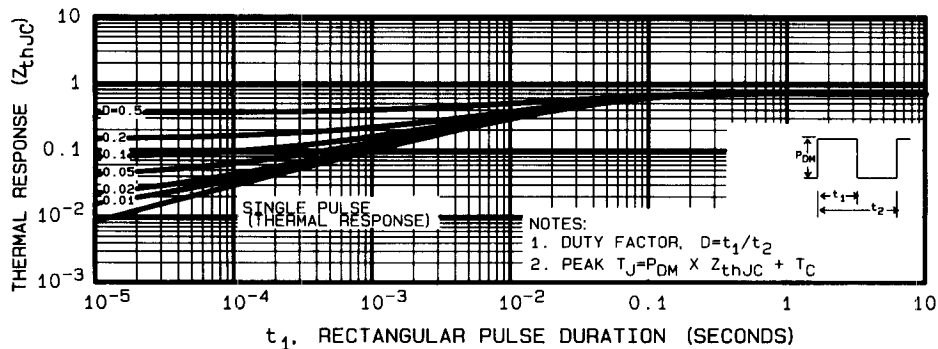


Fig. 5 - Maximum effective transient thermal impedance, junction-to-case vs. pulse duration.

IRFP254, IRFP255, IRFP256, IRFP257

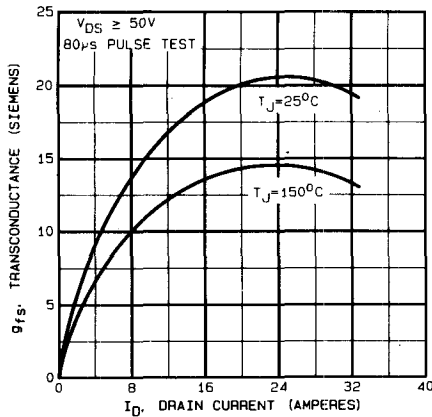


Fig. 6 - Typical transconductance vs. drain current.

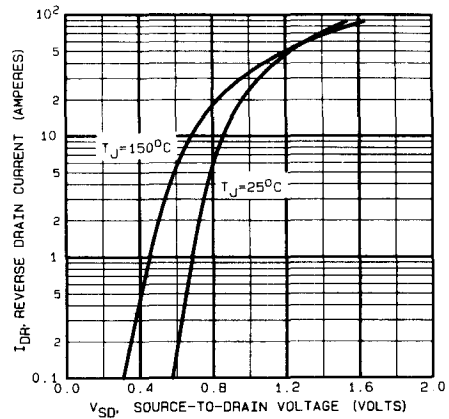


Fig. 7 - Typical source-drain diode forward voltage.

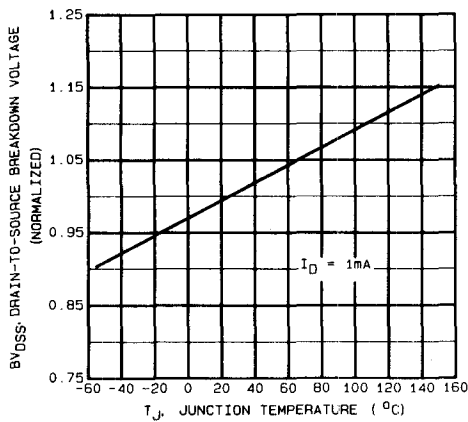


Fig. 8 - Breakdown voltage vs. temperature.

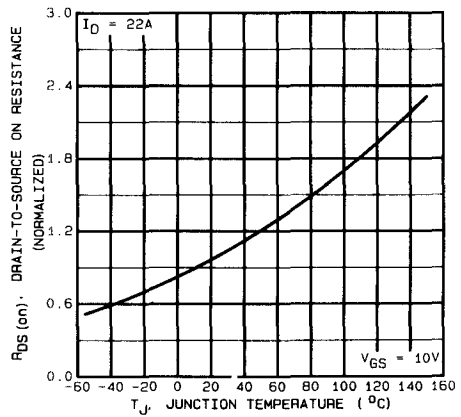


Fig. 9 - Normalized on-resistance vs. temperature.

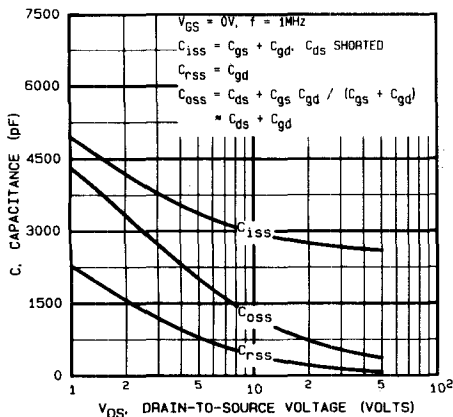


Fig. 10 - Typical capacitance vs. drain-to-source voltage.

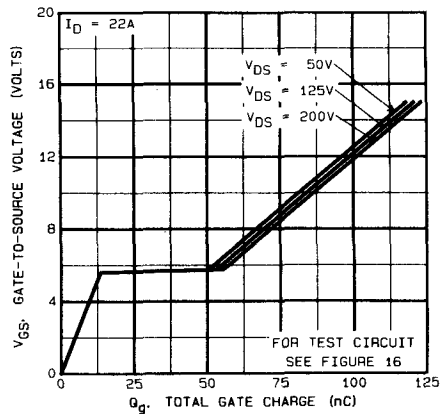


Fig. 11 - Typical gate charge vs. gate-to-source voltage.

IRFP254, IRFP255, IRFP256, IRFP257

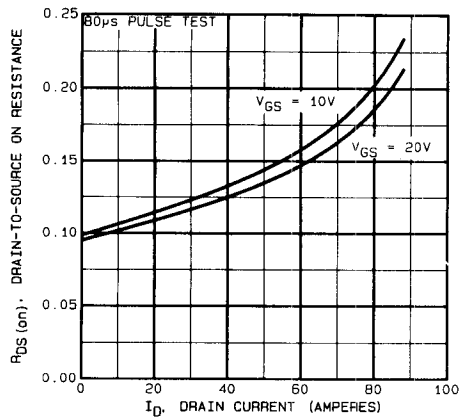


Fig. 12 - Typical on-resistance vs. drain current.

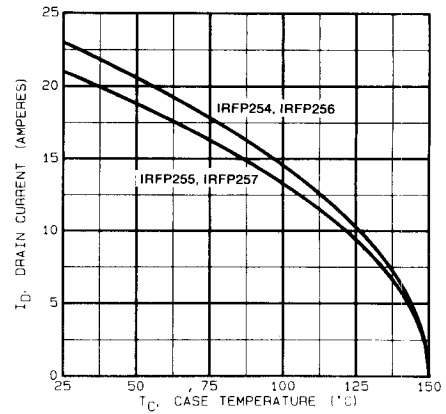


Fig. 13 - Maximum drain current vs. case temperature.

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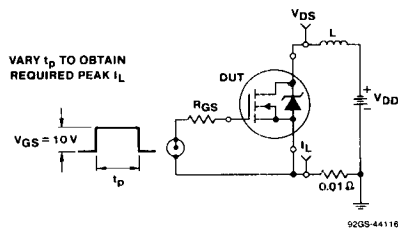


Fig. 14 - Unclamped energy test circuit.

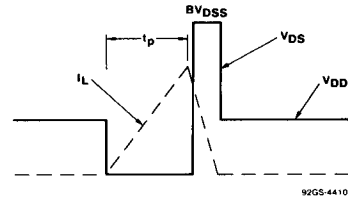


Fig. 15 - Unclamped energy waveforms.

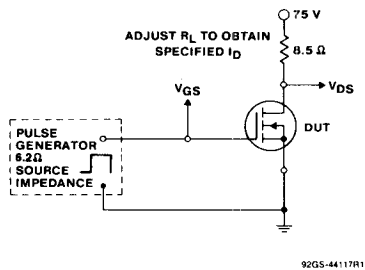


Fig. 16 - Switching time test circuit.

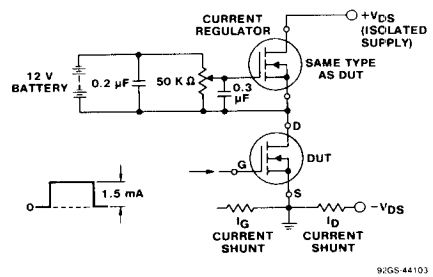


Fig. 17 - Gate charge test circuit.