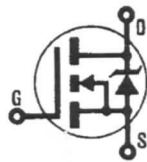


**REPETITIVE AVALANCHE AND dv/dt RATED\***

**HEXFET® TRANSISTORS**



**N-CHANNEL**

**IRF720**  
**IRF721**  
**IRF722**  
**IRF723**

**400 Volt, 1.8 Ohm HEXFET  
 TO-220AB Plastic Package**

**Product Summary**

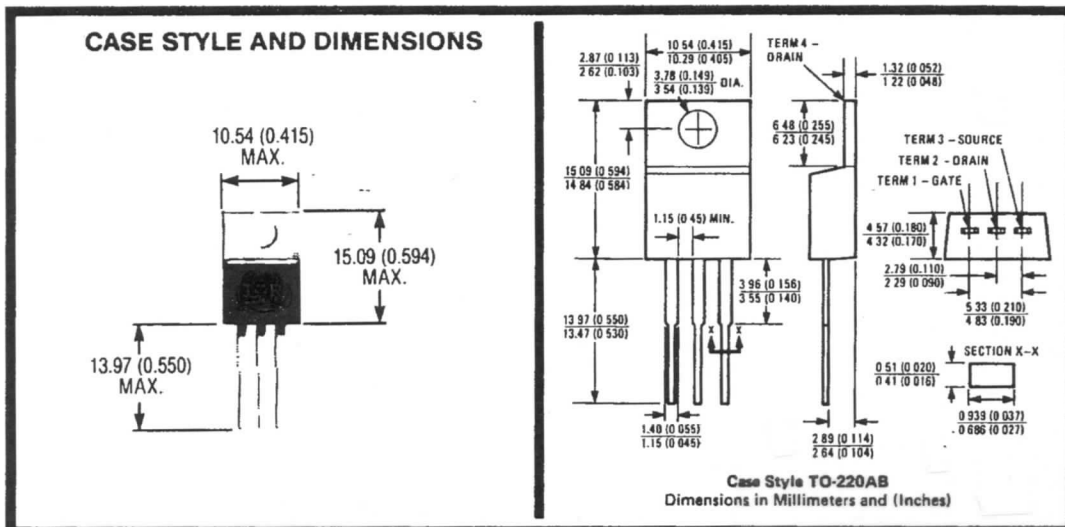
Part Number	BVDSS	R <sub>DS(on)</sub>	I <sub>D</sub>
IRF720	400V	1.8Ω	3.3A
IRF721	350V	1.8Ω	3.3A
IRF722	400V	2.5Ω	2.8A
IRF723	350V	2.5Ω	2.8A

The HEXFET transistors also feature all of the well established advantages of MOSFETs such as voltage control, very fast switching, ease of paralleling and temperature stability of the electrical parameters.

They are well suited for applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers and high energy pulse circuits.

**FEATURES:**

- Repetitive Avalanche Ratings
- Dynamic dv/dt Rating
- Simple Drive Requirements
- Ease of Paralleling



\*This data sheet applies to product with batch codes that begin with a digit, i.e. 2A3B



NJ Semi-Conductors reserves the right to change test conditions, parameter limits and package dimensions without notice. Information furnished by NJ Semi-Conductors is believed to be both accurate and reliable at the time of going to press. However, NJ Semi-Conductors assumes no responsibility for any errors or omissions discovered in its use. NJ Semi-Conductors encourages customers to verify that datasheets are current before placing orders.

**Quality Semi-Conductors**

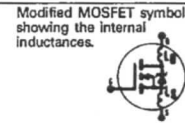
## IRF720, IRF721, IRF722, IRF723 Devices

### Absolute Maximum Ratings

Parameter	IRF720, IRF721	IRF722, IRF723	Units
$I_D @ T_C = 25^\circ\text{C}$ Continuous Drain Current	3.3	2.8	A
$I_D @ T_C = 100^\circ\text{C}$ Continuous Drain Current	2.1	1.8	A
$I_{DM}$ Pulsed Drain Current ①	13	11	A
$P_D @ T_C = 25^\circ\text{C}$ Max. Power Dissipation	50		W
Linear Derating Factor	0.40		W/K ⑤
$V_{GS}$ Gate-to-Source Voltage	$\pm 20$		V
$E_{AS}$ Single Pulse Avalanche Energy ②	190 (See Fig. 14)		mJ
$I_{AR}$ Avalanche Current ③ (Repetitive or Non-Repetitive)	3.3 (See $E_{AR}$ )		A
$E_{AR}$ Repetitive Avalanche Energy ③	5.0 (See $I_{AR}$ )		mJ
$dv/dt$ Peak Diode Recovery $dv/dt$ ④	4.0 (See Fig. 17)		V/ns
$T_J$ Operating Junction $T_{STG}$ Storage Temperature Range	-55 to 150		$^\circ\text{C}$
Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)		$^\circ\text{C}$


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

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
$BV_{DSS}$ Drain-to-Source Breakdown Voltage	IRF720 IRF722	400	—	—	V	$V_{GS} = 0V, I_D = 250\mu\text{A}$
	IRF721 IRF723	350	—	—	V	
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance ④	IRF720 IRF721	—	1.6	1.8	$\Omega$	$V_{GS} = 10V, I_D = 1.8A$
	IRF722 IRF723	—	1.8	2.5	$\Omega$	
$I_{D(on)}$ On-State Drain Current ④	IRF720 IRF721	3.3	—	—	A	$V_{DS} > I_{D(on)} \times R_{DS(on)}$ Max. $V_{GS} = 10V$
	IRF722 IRF723	2.8	—	—	A	
$V_{GS(th)}$ Gate Threshold Voltage	ALL	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
$g_{fs}$ Forward Transconductance ④	ALL	1.8	2.7	—	S (①)	$I_{DS} = 1.8A, V_{DS} \geq 50V$
$I_{DSS}$ Zero Gate Voltage Drain Current	ALL	—	—	250	$\mu\text{A}$	$V_{DS} = \text{Max. Rating}, V_{GS} = 0V$
		—	—	1000	$\mu\text{A}$	$V_{DS} = 0.8 \times \text{Max. Rating}$ $V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$ Gate-to-Source Leakage Forward	ALL	—	—	500	nA	$V_{GS} = 20V$
$I_{GSS}$ Gate-to-Source Leakage Reverse	ALL	—	—	-500	nA	$V_{GS} = -20V$
$Q_g$ Total Gate Charge	ALL	—	13	20	nC	$V_{GS} = 10V, I_D = 3.3A$
$Q_{gs}$ Gate-to-Source Charge	ALL	—	2.2	3.3	nC	$V_{DS} = 0.8 \times \text{Max. Rating}$ See Fig. 16
$Q_{gd}$ Gate-to-Drain ("Miller") Charge	ALL	—	7.2	11	nC	(Independent of operating temperature)
$t_{d(on)}$ Turn-On Delay Time	ALL	—	10	15	ns	$V_{DD} = 200V, I_D = 3.3A, R_G = 18\Omega$
$t_r$ Rise Time	ALL	—	14	21	ns	$R_D = 56\Omega$
$t_{d(off)}$ Turn-Off Delay Time	ALL	—	30	45	ns	See Fig. 15
$t_f$ Fall Time	ALL	—	13	20	ns	(Independent of operating temperature)
$L_D$ Internal Drain Inductance	ALL	—	4.5	—	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die.
$L_S$ Internal Source Inductance	ALL	—	7.5	—	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad.
$C_{iss}$ Input Capacitance	ALL	—	350	—	pF	$V_{GS} = 0V, V_{DS} = 25V$
$C_{oss}$ Output Capacitance	ALL	—	64	—	pF	$f = 1.0\text{ MHz}$
$C_{rss}$ Reverse Transfer Capacitance	ALL	—	8.1	—	pF	See Fig. 10



# IRF720, IRF721, IRF722, IRF723 Devices

## Source-Drain Diode Ratings and Characteristics

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
$I_S$ Continuous Source Current (Body Diode)	ALL	—	—	3.3	A	Modified MOSFET symbol showing the integral Reverse p-n junction rectifier. 
$I_{SM}$ Pulsed Source Current (Body Diode) ①	ALL	—	—	13	A	
$V_{SD}$ Diode Forward Voltage ②	ALL	—	—	1.6	V	$T_J = 25^\circ\text{C}$ , $I_S = 3.3\text{A}$ , $V_{GS} = 0\text{V}$
$t_{rr}$ Reverse Recovery Time	ALL	120	270	600	ns	$T_J = 25^\circ\text{C}$ , $I_F = 3.3\text{A}$ , $di/dt = 100\text{ A}/\mu\text{s}$
$Q_{RR}$ Reverse Recovery Charge	ALL	0.64	1.4	3.0	$\mu\text{C}$	
$t_{on}$ Forward Turn-On Time	ALL	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by $L_S + L_D$ .				

## Thermal Resistance

$R_{thJC}$ Junction-to-Case	ALL	—	—	2.5	K/W ③	
$R_{thCS}$ Case-to-Sink	ALL	—	0.50	—	K/W ③	Mounting surface flat, smooth, and greased
$R_{thJA}$ Junction-to-Ambient	ALL	—	—	80	K/W ③	Typical socket mount

## Typical SPICE Computer Model Parameters (For More Information See Application Note AN-975)

Device	Level, SPICE MOSFET Model	W (m), Channel Width	L (μm), Channel Length	Theta (1/V), Mobility Modulation	UO (CM <sup>2</sup> /V-S), Surface Mobility	VTO (V), Threshold Voltage	R1 (Ω), Drain Resistance	R2 (Ω), Source Resistance	RG (Ω), Gate Resistance
ALL	3	0.279	1.2	0.30	450	4.00	1.4	0.02	1.5

CGSO (pF), Gate-Source Capacitance	CGD (fF), Gate-Drain Capacitance	E1 (V), Voltage Dependent Voltage Source	LD (nH), Drain Inductance	LS (nH), Source Inductance	LG (nH), Gate Inductance	IS (A), Diode Saturation Current	RS (Ω), Diode Bulk Resistance
770	C6	$2 + 0.995 V_{DG}$	4.5	7.5	7.5	$3.6 \times 10^{-13}$	0.026

$$C6 = 1500 \text{ pf} + 1.8 \times 10^{-22} (V_{GE})^{1.8}$$

① Repetitive Rating: Pulse width limited by maximum junction temperature (see figure 5) Refer to current HEXFET reliability report

② @  $V_{DD} = 60\text{V}$ , Starting  $T_J = 25^\circ\text{C}$ ,  $L = 31\text{ mH}$ ,  $R_G = 25\Omega$ , Peak  $I_L = 3.3\text{A}$ .

③  $I_{SD} \leq 3.3\text{A}$ ,  $di/dt \leq 66\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ ,  $T_J \leq 150^\circ\text{C}$   
Suggested  $R_G = 18\Omega$

④  $K/W = ^\circ\text{C}/\text{W}$   
 $W/K = \text{W}/^\circ\text{C}$

⑤ Pulse width  $\leq 300\ \mu\text{s}$ ; Duty Cycle  $\leq 2\%$

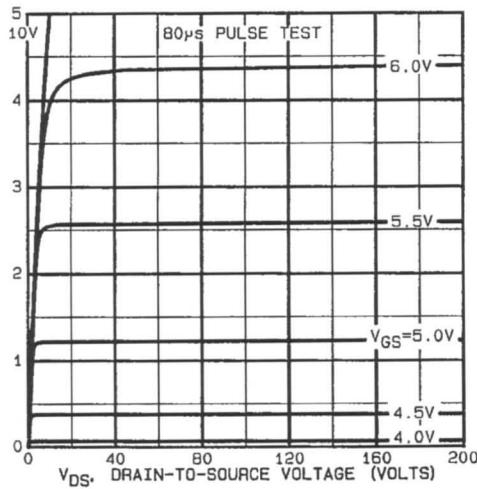


Fig. 1 — Typical Output Characteristics

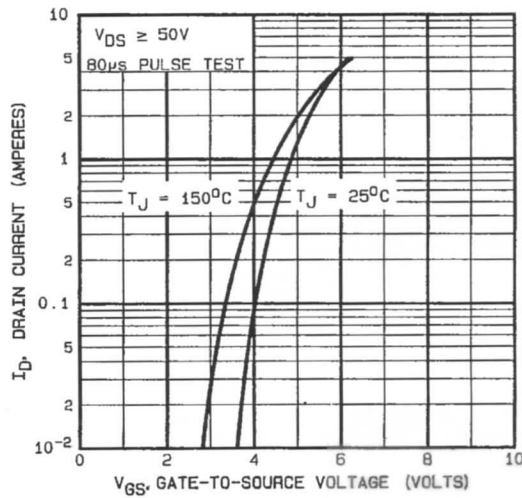


Fig. 2.— Typical Transfer Characteristics