

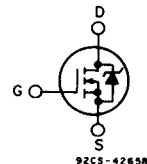
Avalanche Energy Rated N-Channel Power MOSFETs

2.0A and 2.5A, 450V-500V
 $r_{DS(on)} = 3.0\Omega$ and 4.0Ω

Features:

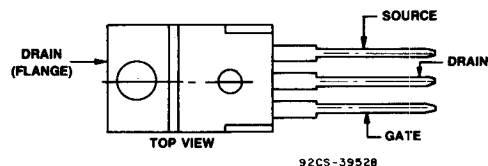
- Single pulse avalanche energy rated
- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance

N-CHANNEL ENHANCEMENT MODE



TERMINAL DIAGRAM

TERMINAL DESIGNATION



JEDEC TO-220AB

The IRF820R, IRF821R, IRF822R and IRF823R 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 IRF-types are supplied in the JEDEC TO-220AB plastic package.

Absolute Maximum Ratings

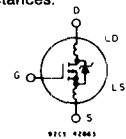
Parameter	IRF820R	IRF821R	IRF822R	IRF823R	Units
V_{DS} Drain - Source Voltage ①	500	450	500	450	V
V_{DGR} Drain - Gate Voltage ($R_{GS} = 20\text{ K}\Omega$) ①	500	450	500	450	V
$I_D @ T_C = 25^\circ\text{C}$ Continuous Drain Current	2.5	2.5	2.0	2.0	A
$I_D @ T_C = 100^\circ\text{C}$ Continuous Drain Current	1.5	1.5	1.0	1.0	A
I_{DM} Pulsed Drain Current ③	10	10	8.0	8.0	A
V_{GS} Gate - Source Voltage	± 20				V
$P_D @ T_C = 25^\circ\text{C}$ Max. Power Dissipation	40 (See Fig. 14)				W
Linear Derating Factor	0.32 (See Fig. 14)				W/ $^\circ\text{C}$
E_{AS} Single Pulse Avalanche Energy Rating ④	210				mJ
T_J Operating Junction and Storage Temperature Range	-55 to 150				$^\circ\text{C}$
Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				$^\circ\text{C}$

IRF820R, IRF821R, IRF822R, IRF823R

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	IRF820R	500	—	—	V	$V_{GS} = 0\text{V}$
	IRF822R	—	—	—	—	—
	IRF821R	450	—	—	V	$I_D = 250\mu\text{A}$
	IRF823R	—	—	—	—	—
V _{GS(th)} Gate Threshold Voltage	ALL	2.0	—	4.0	V	$V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$
I _{GSS} Gate-Source Leakage Forward	ALL	—	—	500	nA	$V_{GS} = 20\text{V}$
I _{GSS} Gate-Source Leakage Reverse	ALL	—	—	-500	nA	$V_{GS} = -20\text{V}$
I _{DSS} Zero Gate Voltage Drain Current	ALL	—	—	250	μA	$V_{DS} = \text{Max. Rating}$, $V_{GS} = 0\text{V}$
		—	—	1000	μA	$V_{DS} = \text{Max. Rating} \times 0.8$, $V_{GS} = 0\text{V}$, $T_c = 125^\circ\text{C}$
I _{D(on)} On-State Drain Current ②	IRF820R	2.5	—	—	A	$V_{DS} > I_{D(on)} \times R_{DS(on) \text{ max.}}$, $V_{GS} = 10\text{V}$
	IRF821R	—	—	—	—	
	IRF822R	2.0	—	—	A	
	IRF823R	—	—	—	—	
R _{DS(on)} Static Drain-Source On-State Resistance ②	IRF820R	—	2.5	3.0	Ω	$V_{GS} = 10\text{V}$, $I_D = 1.0\text{A}$
	IRF821R	—	—	—	—	
	IRF822R	—	3.0	4.0	Ω	
	IRF823R	—	—	—	—	
g _{fs} Forward Transconductance ②	ALL	1.0	1.75	—	S (Ω)	$V_{DS} > I_{D(on)} \times R_{DS(on) \text{ max.}}$, $I_D = 1.0\text{A}$
C _{iss} Input Capacitance	ALL	—	300	—	pF	$V_{GS} = 0\text{V}$, $V_{DS} = 25\text{V}$, $f = 1.0\text{MHz}$
C _{oss} Output Capacitance	ALL	—	75	—	pF	See Fig. 10
C _{rss} Reverse Transfer Capacitance	ALL	—	20	—	pF	—
t _{don} Turn-On Delay Time	ALL	—	30	60	ns	$V_{DD} \approx 0.5BV_{DSS}$, $I_D = 1.0\text{A}$, $Z_\theta = 50\Omega$
t _r Rise Time	ALL	—	25	50	ns	See Fig. 17
t _{doff} Turn-Off Delay Time	ALL	—	30	60	ns	(MOSFET switching times are essentially independent of operating temperature.)
t _f Fall Time	ALL	—	15	30	ns	—
Q _g Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	11	26	nC	$V_{GS} = 10\text{V}$, $I_D = 3.0\text{A}$, $V_{DS} = 0.8\text{V}$ Max. Rating. See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)
Q _{gs} Gate-Source Charge	ALL	—	5.0	—	nC	—
Q _{gd} Gate-Drain ("Miller") Charge	ALL	—	6.0	—	nC	—
L _D Internal Drain Inductance	ALL	—	3.5	—	nH	Measured from the contact screw on tab to center of die.
		—	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.

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Thermal Resistance

R _{thJC} Junction-to-Case	ALL	—	—	3.12	$^\circ\text{C/W}$	—
R _{thCS} Case-to-Sink	ALL	—	1.0	—	$^\circ\text{C/W}$	Mounting surface flat, smooth, and greased.
R _{thJA} Junction-to-Ambient	ALL	—	—	80	$^\circ\text{C/W}$	Free Air Operation

Source-Drain Diode Ratings and Characteristics

I _S Continuous Source Current (Body Diode)	IRF820R	—	—	2.5	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
	IRF821R	—	—	—	—	
	IRF822R IRF823R	—	—	2.0	A	
I _{SM} Pulse Source Current (Body Diode) ③	IRF820R	—	—	10	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
	IRF821R	—	—	—	—	
	IRF822R IRF823R	—	—	8.0	A	
V _{SD} Diode Forward Voltage ②	IRF820R	—	—	1.6	V	$T_c = 25^\circ\text{C}$, $I_S = 2.5\text{A}$, $V_{GS} = 0\text{V}$
	IRF821R	—	—	—	—	—
	IRF822R IRF823R	—	—	1.5	V	$T_c = 25^\circ\text{C}$, $I_S = 2.0\text{A}$, $V_{GS} = 0\text{V}$
t _{rr} Reverse Recovery Time	ALL	—	600	—	ns	$T_J = 150^\circ\text{C}$, $I_F = 2.5\text{A}$, $dI_F/dt = 100\text{A}/\mu\text{s}$
Q _{RR} Reverse Recovered Charge	ALL	—	3.5	—	μC	$T_J = 150^\circ\text{C}$, $I_F = 2.5\text{A}$, $dI_F/dt = 100\text{A}/\mu\text{s}$
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 $T_J = 25^\circ\text{C}$ to 150°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. See Transient Thermal Impedance Curve (Fig. 5).

④ $V_{DD} = 5\text{V}$, starting $T_J = 25^\circ\text{C}$, $L = 60\text{mH}$, $R_{GS} = 25\Omega$, $I_{peak} = 2.5\text{A}$. See figures 15, 16.

IRF820R, IRF821R, IRF822R, IRF823R

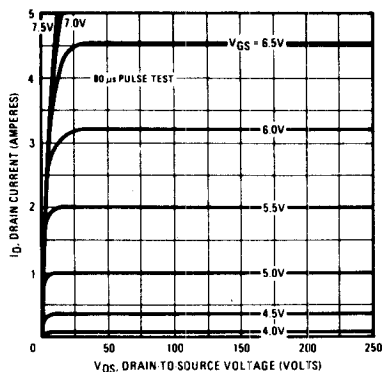


Fig. 1 — Typical Output Characteristics

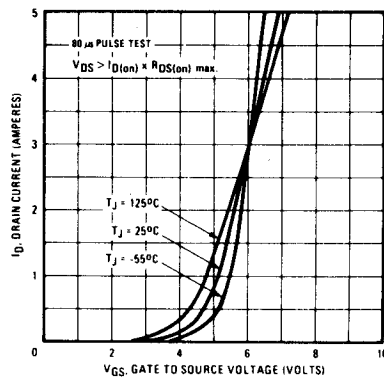


Fig. 2 — Typical Transfer Characteristics

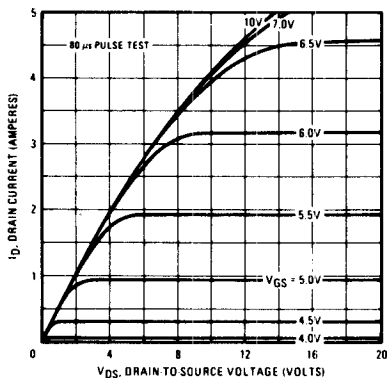


Fig. 3 — Typical Saturation Characteristics

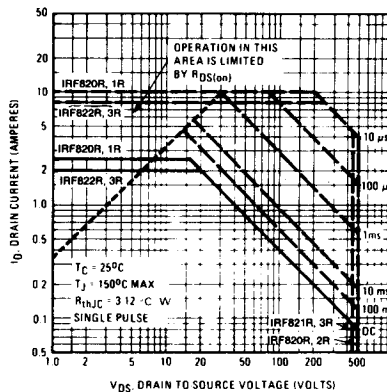


Fig. 4 — Maximum Safe Operating Area

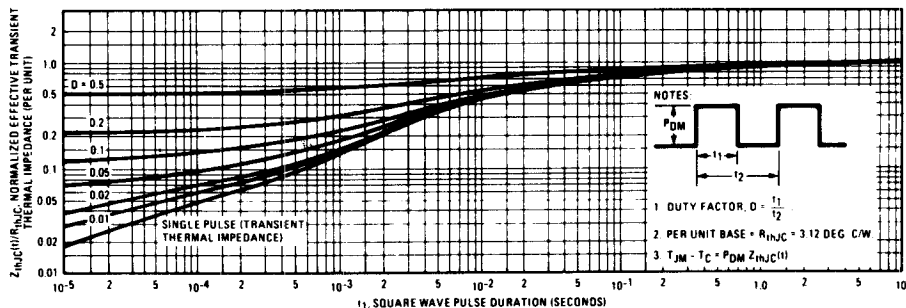


Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

IRF820R, IRF821R, IRF822R, IRF823R

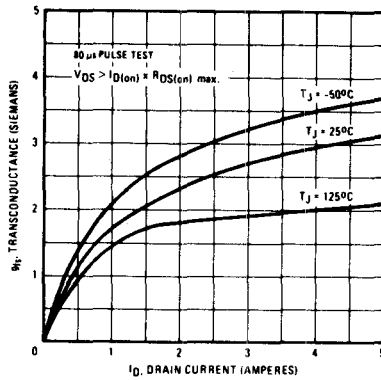


Fig. 6 - Typical Transconductance Vs. Drain Current

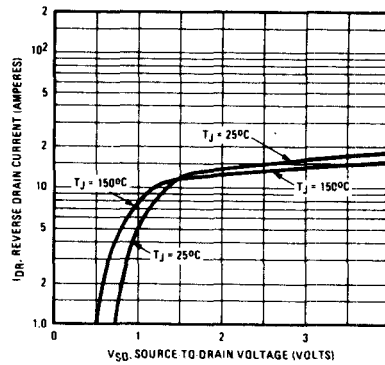


Fig. 7 - Typical Source-Drain Diode Forward Voltage

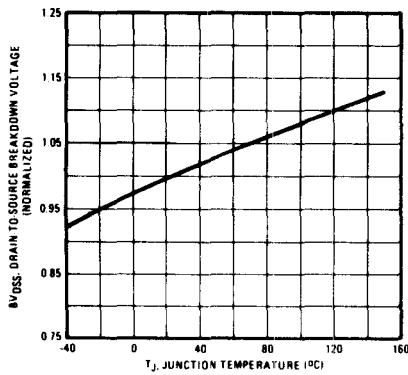


Fig. 8 - Breakdown Voltage Vs. Temperature

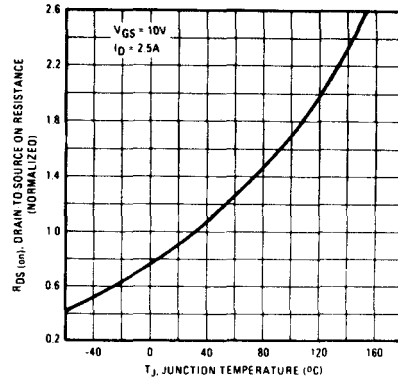


Fig. 9 - Normalized On-Resistance Vs. Temperature

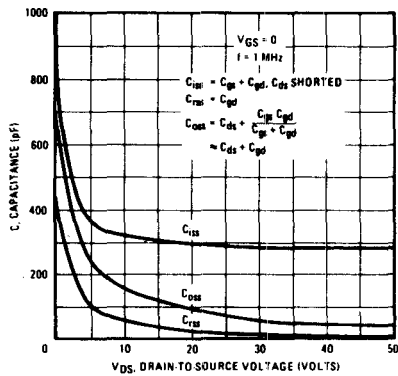


Fig. 10 - Typical Capacitance Vs. Drain-to-Source Voltage

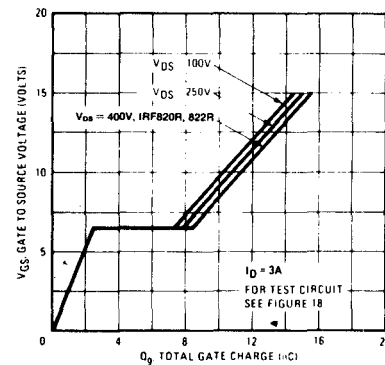


Fig. 11 - Typical Gate Charge Vs. Gate-to-Source Voltage

IRF820R, IRF821R, IRF822R, IRF823R

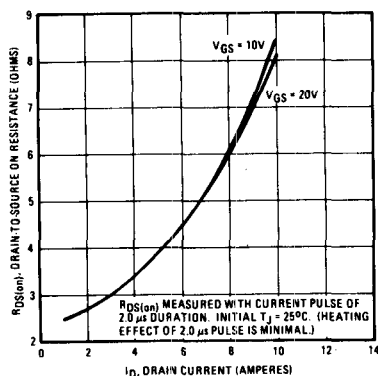


Fig. 12 — Typical On-Resistance Vs. Drain Current

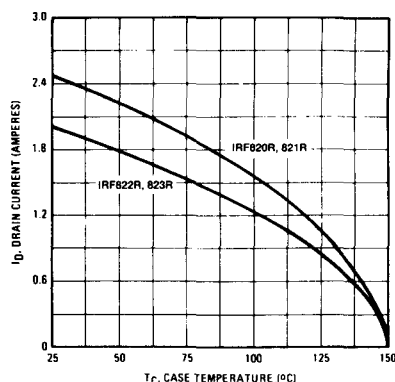


Fig. 13 — Maximum Drain Current Vs. Case Temperature

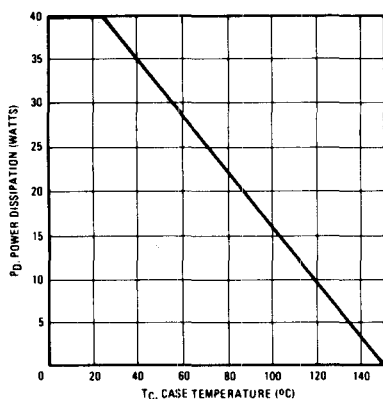


Fig. 14 — Power Vs. Temperature Derating Curve

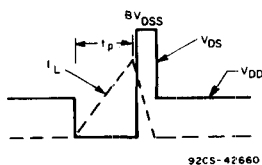


Fig. 16 — Unclamped Energy Waveforms

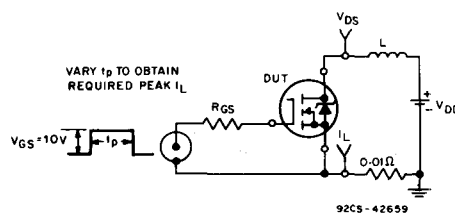


Fig. 15 — Unclamped Energy Test Circuit

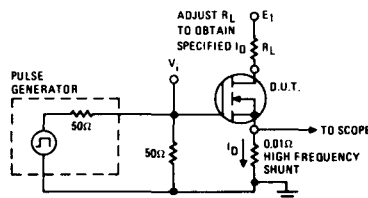


Fig. 17 — Switching Time Test Circuit

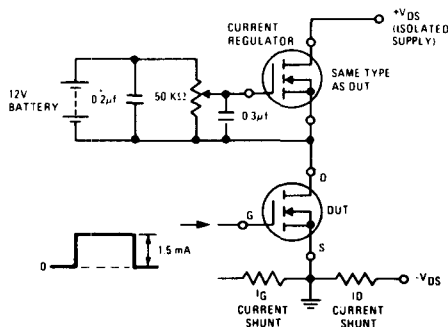


Fig. 18 — Gate Charge Test Circuit