

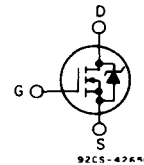
Avalanche Energy Rated N-Channel Power MOSFETs

4.0A and 4.5A, 450V-500V
 $r_{DS(on)} = 1.5\Omega$ and 2.0Ω

Features:

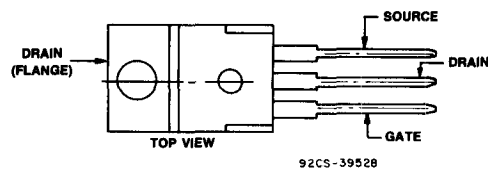
- Single pulse avalanche energy rated
- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance

N-CHANNEL ENHANCEMENT MODE



TERMINAL DIAGRAM

TERMINAL DESIGNATION



JEDEC TO-220AB

The IRF830R, IRF831R, IRF832R and IRF833R 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.

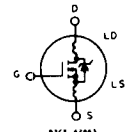
Absolute Maximum Ratings

Parameter	IRF830R	IRF831R	IRF832R	IRF833R	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	4.5	4.5	4.0	4.0	A
$I_D @ T_c = 100^\circ\text{C}$ Continuous Drain Current	3.0	3.0	2.5	2.5	A
I_{DM} Pulsed Drain Current ③	18	18	16	16	A
V_{GS} Gate - Source Voltage	± 20				V
$P_D @ T_c = 25^\circ\text{C}$ Max. Power Dissipation	75 (See Fig. 14)				W
Linear Derating Factor	0.6 (See Fig. 14)				W/ $^\circ\text{C}$
E_{AS} Single Pulse Avalanche Energy Rating ④	300				mJ
T_J Operating Junction and Storage Temperature Range	-55 to 150				$^\circ\text{C}$
T_{slg} Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				$^\circ\text{C}$

IRF830R, IRF831R, IRF832R, IRF833R

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	IRF830R IRF832R IRF831R IRF833R	500 450	— —	— —	V V	$V_{GS} = 0V$ $I_D = 250\mu A$
$V_{GS(th)}$ Gate Threshold Voltage	ALL	2.0	—	4.0	V	$V_{DS} = V_{GS}$, $I_D = 250\mu A$
I_{GSS} Gate-Source Leakage Forward	ALL	—	—	500	nA	$V_{GS} = 20V$
I_{GSS} Gate-Source Leakage Reverse	ALL	—	—	-500	nA	$V_{GS} = -20V$
I_{DSS} Zero Gate Voltage Drain Current	ALL	—	—	250 1000	μA μA	$V_{DS} = \text{Max. Rating}$, $V_{GS} = 0V$ $V_{DS} = \text{Max. Rating} \times 0.8$, $V_{GS} = 0V$, $T_c = 125^\circ\text{C}$
$I_{D(on)}$ On-State Drain Current ②	IRF830R IRF831R IRF832R IRF833R	4.5 4.0	— —	— —	A A	$V_{DS} > I_{D(on)} \times R_{DS(on) \text{ max.}}$, $V_{GS} = 10V$
$R_{DS(on)}$ Static Drain-Source On-State Resistance ②	IRF830R IRF831R IRF832R IRF833R	— —	1.3 1.5	1.5 2.0	Ω Ω	$V_{GS} = 10V$, $I_D = 2.5A$
g_{fs} Forward Transconductance ②	ALL	2.5	3.25	—	S(①)	$V_{DS} > I_{D(on)} \times R_{DS(on) \text{ max.}}$, $I_D = 2.5A$
C_{iss} Input Capacitance	ALL	—	600	—	pF	$V_{GS} = 0V$, $V_{DS} = 25V$, $f = 1.0 \text{ MHz}$
C_{oss} Output Capacitance	ALL	—	100	—	pF	See Fig. 10
C_{rss} Reverse Transfer Capacitance	ALL	—	30	—	pF	
$t_{d(on)}$ Turn-On Delay Time	ALL	—	—	30	ns	$V_{DD} = 225V$, $I_D = 2.5A$, $Z_0 = 15\Omega$
t_r Rise Time	ALL	—	—	30	ns	See Fig. 17
$t_{d(off)}$ Turn-Off Delay Time	ALL	—	—	55	ns	(MOSFET switching times are essentially independent of operating temperature.)
t_f Fall Time	ALL	—	—	30	ns	
Q_g Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	22	39	nC	$V_{GS} = 10V$, $I_D = 6.0A$, $V_{DS} = 0.8V$ Max. Rating. See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)
Q_{gs} Gate-Source Charge	ALL	—	11	—	nC	
Q_{gd} Gate-Drain ("Miller") Charge	ALL	—	11	—	nC	
L_D Internal Drain Inductance	ALL	—	3.5 4.5	—	nH nH	Measured from the contact screw on tab to center of die. 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.

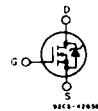


Thermal Resistance

R_{thJC} Junction-to-Case	ALL	—	—	1.67	$^\circ\text{C/W}$	
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)	IRF830R IRF831R IRF832R IRF833R	— —	— —	4.5 4.0	A A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
I_{SM} Pulse Source Current (Body Diode) ③	IRF830R IRF831R IRF832R IRF833R	— —	— —	18 16	A A	
V_{SD} Diode Forward Voltage ②	IRF830R IRF831R IRF832R IRF833R	— —	— —	1.6 1.5	V V	$T_c = 25^\circ\text{C}$, $I_S = 4.5A$, $V_{GS} = 0V$ $T_c = 25^\circ\text{C}$, $I_S = 4.0A$, $V_{GS} = 0V$
t_{rr} Reverse Recovery Time	ALL	—	800	—	ns	$T_J = 150^\circ\text{C}$, $I_F = 4.5A$, $dI_F/dt = 100A/\mu s$
Q_{RR} Reverse Recovered Charge	ALL	—	4.6	—	μC	$T_J = 150^\circ\text{C}$, $I_F = 4.5A$, $dI_F/dt = 100A/\mu s$
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 $\leq 300\mu s$, 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 $T_J = 25^\circ\text{C}$, $L = 25mH$, $R_{gs} = 25\Omega$, $I_{peak} = 4.5A$. See figures 15, 16.

IRF830R, IRF831R, IRF832R, IRF833R

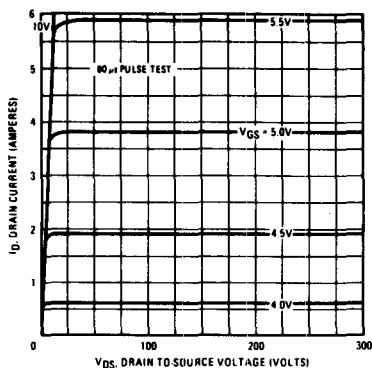


Fig. 1 - Typical Output Characteristics

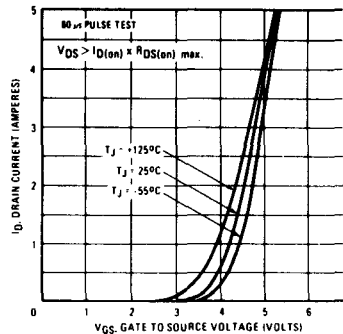


Fig. 2 - Typical Transfer Characteristics

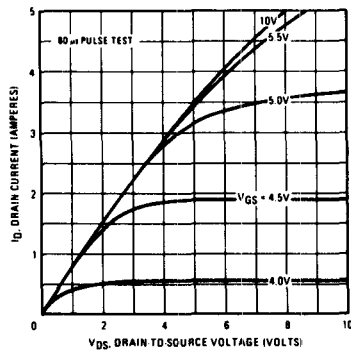


Fig. 3 - Typical Saturation Characteristics

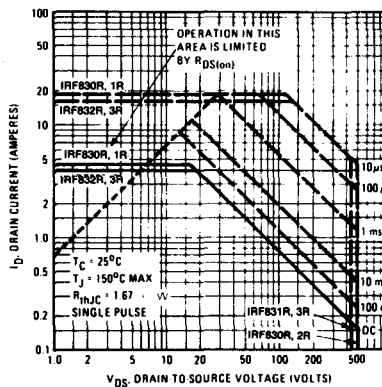


Fig. 4 - Maximum Safe Operating Area

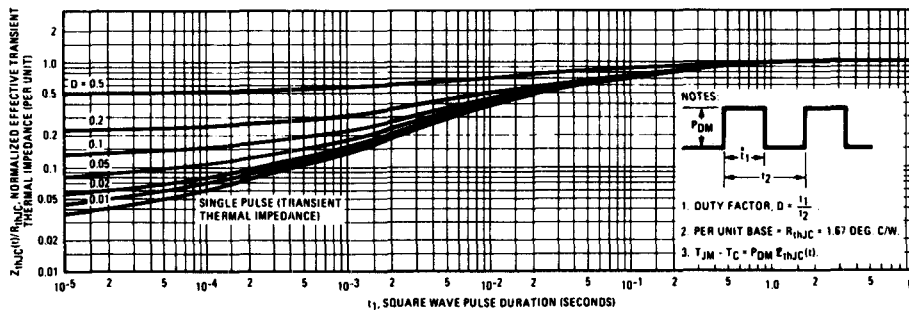


Fig. 5 - Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

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IRF830R, IRF831R, IRF832R, IRF833R

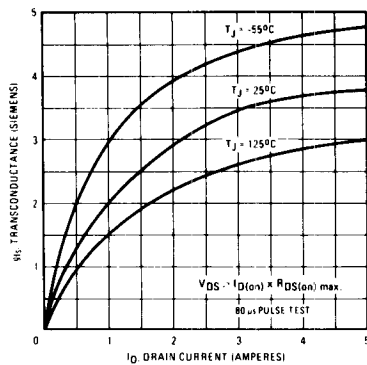


Fig. 6 - Typical Transconductance Vs. Drain Current

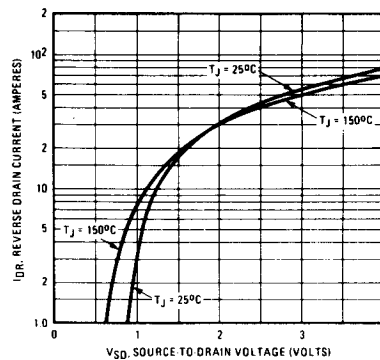


Fig. 7 - Typical Source-Drain Diode Forward Voltage

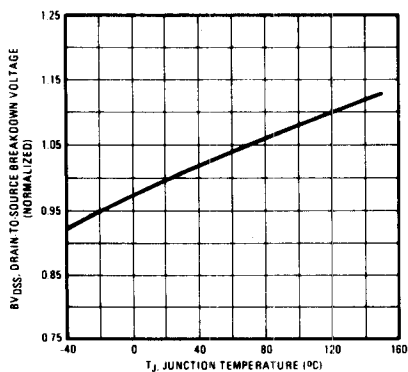


Fig. 8 - Breakdown Voltage Vs. Temperature

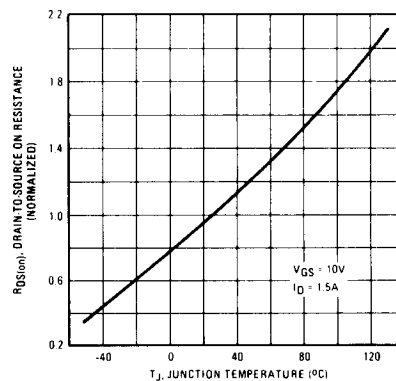


Fig. 9 - Normalized On-Resistance Vs. Temperature

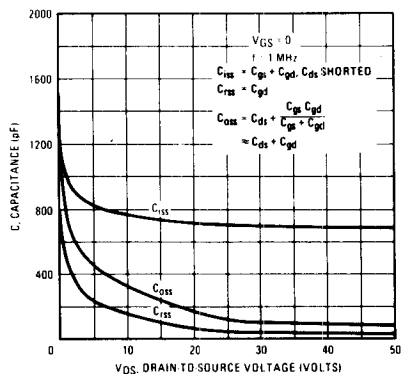


Fig. 10 - Typical Capacitance Vs. Drain-to-Source Voltage

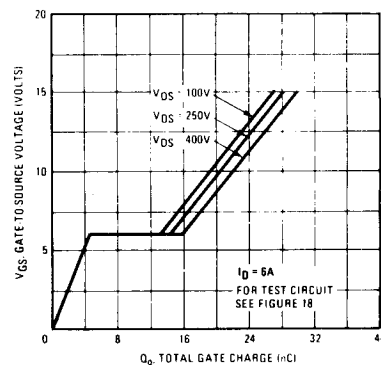


Fig. 11 - Typical Gate Charge Vs. Gate-to-Source Voltage

IRF830R, IRF831R, IRF832R, IRF833R

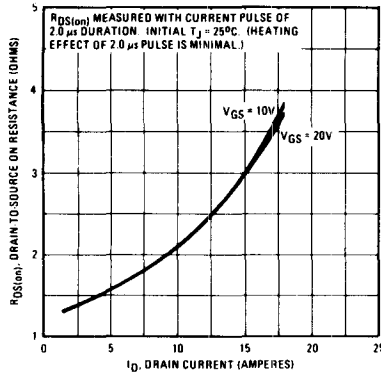


Fig. 12 - Typical On-Resistance Vs. Drain Current

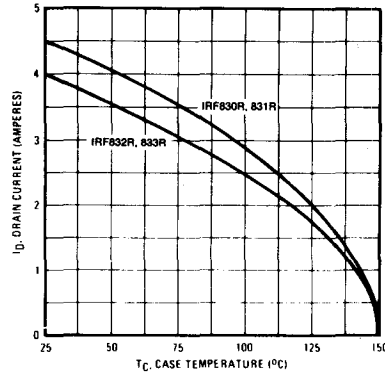


Fig. 13 - Maximum Drain Current Vs. Case Temperature

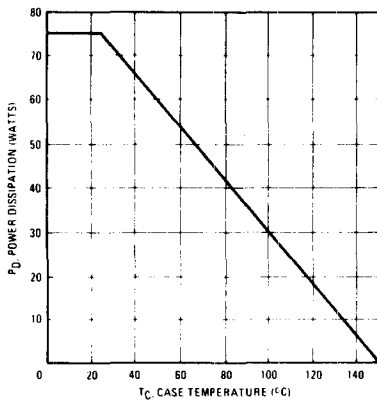


Fig. 14 - Power Vs. Temperature Derating Curve

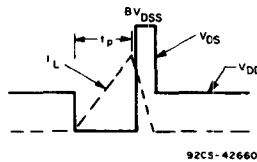


Fig. 16 - Unclamped Energy Waveforms

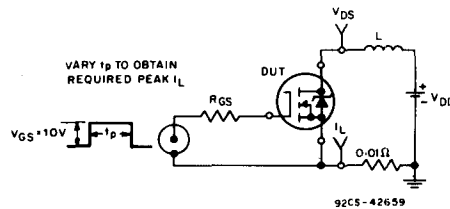


Fig. 15 - Unclamped Energy Test Circuit

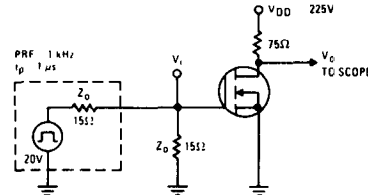


Fig. 17 - Switching Time Test Circuit

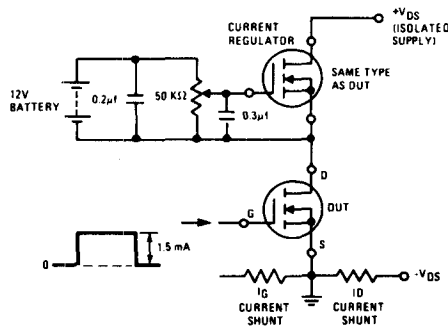


Fig. 18 - Gate Charge Test Circuit