

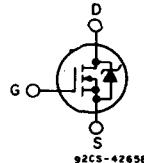
Avalanche Energy Rated N-Channel Power MOSFETs

12A and 14A, 60V-100V
 $r_{ds(on)} = 0.18\Omega$ and 0.25Ω

Features:

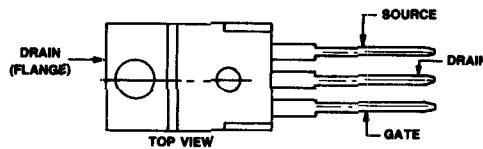
- Single pulse avalanche energy rated
- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance

N-CHANNEL ENHANCEMENT MODE



TERMINAL DIAGRAM

TERMINAL DESIGNATION



JEDEC TO-220AB

The IRF530R, IRF531R, IRF532R and IRF533R 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.

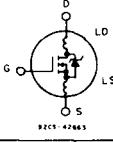
The IRF-types are supplied in the JEDEC TO-220AB plastic package.

Absolute Maximum Ratings

Parameter	IRF530R	IRF531R	IRF532R	IRF533R	Units
V_{DS} Drain - Source Voltage ①	100	60	100	60	V
V_{DGS} Drain - Gate Voltage ($R_{DS(on)} = 20\text{ k}\Omega$) ①	100	60	100	60	V
$I_D @ T_c = 25^\circ\text{C}$ Continuous Drain Current	14	14	12	12	A
$I_D @ T_c = 100^\circ\text{C}$ Continuous Drain Current	9.0	9.0	8.0	8.0	A
I_{DM} Pulsed Drain Current ③	56	56	48	48	A
V_{GS} Gate - Source Voltage			± 20		V
$P_D @ T_c = 25^\circ\text{C}$ Max. Power Dissipation			75 (See Fig. 14)		W
			0.6 (See Fig. 14)		$\text{W}/^\circ\text{C}$
E_{AS} Single Pulse Avalanche Energy Rating ④			69		mJ
T_J T_{STG} Operating Junction and Storage Temperature Range			-55 to 150		$^\circ\text{C}$
Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				$^\circ\text{C}$

IRF530R, IRF531R, IRF532R, IRF533R

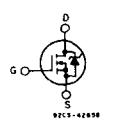
Electrical Characteristics @ $T_c = 25^\circ\text{C}$ (Unless Otherwise Specified)

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions	
$\text{BV}_{\text{DS}}(\text{S})$ Drain - Source Breakdown Voltage	IRF530R IRF532R	100	—	—	V	$\text{V}_{\text{GS}} = 0\text{V}$	
	IRF531R IRF533R	60	—	—	V	$I_D = 250\mu\text{A}$	
$\text{V}_{\text{GS(th)}}$ Gate Threshold Voltage	ALL	2.0	—	4.0	V	$\text{V}_{\text{DS}} = \text{V}_{\text{GS}}, I_D = 250\mu\text{A}$	
I_{SS} Gate-Source Leakage Forward	ALL	—	—	500	nA	$\text{V}_{\text{GS}} = 20\text{V}$	
I_{RS} Gate-Source Leakage Reverse	ALL	—	—	-500	nA	$\text{V}_{\text{GS}} = -20\text{V}$	
$\text{I}_{\text{DS(0)}}$ Zero Gate Voltage Drain Current	ALL	—	—	250	μA	$\text{V}_{\text{DS}} = \text{Max. Rating}, \text{V}_{\text{GS}} = 0\text{V}$	
	ALL	—	—	1000	μA	$\text{V}_{\text{DS}} = \text{Max. Rating} \times 0.8, \text{V}_{\text{GS}} = 0\text{V}, T_c = 125^\circ\text{C}$	
$\text{I}_{\text{D(on)}}$ On-State Drain Current ②	IRF530R IRF531R	14	—	—	A	$\text{V}_{\text{DS}} > \text{I}_{\text{D(on)}} \times \text{R}_{\text{DS(on)}}, \text{V}_{\text{GS}} = 10\text{V}$	
	IRF532R IRF533R	12	—	—	A		
$\text{R}_{\text{DS(on)}}$ Static Drain-Source On-State Resistance ②	IRF530R IRF531R	—	0.14	0.18	Ω	$\text{V}_{\text{GS}} = 10\text{V}, I_D = 8.0\text{A}$	
	IRF532R IRF533R	—	0.20	0.25	Ω		
g_{fs} Forward Transconductance ②	ALL	4.0	5.5	—	S (mS)	$\text{V}_{\text{DS}} > \text{I}_{\text{D(on)}} \times \text{R}_{\text{DS(on)max}}, I_D = 8.0\text{A}$	
C_{iss} Input Capacitance	ALL	—	600	—	pF	$\text{V}_{\text{GS}} = 0\text{V}, \text{V}_{\text{DS}} = 25\text{V}, f = 1.0 \text{ MHz}$ See Fig. 10	
C_{oss} Output Capacitance	ALL	—	300	—	pF		
C_{rrs} Reverse Transfer Capacitance	ALL	—	100	—	pF		
t_{on} Turn-On Delay Time	ALL	—	—	30	ns	$\text{V}_{\text{DD}} = 36\text{V}, I_D = 8.0\text{A}, Z_0 = 15\Omega$	
t_r Rise Time	ALL	—	—	75	ns	See Fig. 17	
t_{off} Turn-Off Delay Time	ALL	—	—	40	ns	(MOSFET switching times are essentially independent of operating temperature.)	
t_f Fall Time	ALL	—	—	45	ns		
Q_g Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	18	30	nC	$\text{V}_{\text{GS}} = 10\text{V}, I_D = 18\text{A}, \text{V}_{\text{DS}} = 0.8 \text{ Max. Rating}$ See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)	
Q_{gs} Gate-Source Charge	ALL	—	9.0	—	nC		
Q_{gd} Gate-Drain ("Miller") Charge	ALL	—	9.0	—	nC		
L_d Internal Drain Inductance	ALL	—	3.5	—	nH	Measured from the contact screw on tab to center of die.	Modified MOSFET symbol showing the internal device inductances. 
		—	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.	

Thermal Resistance

R_{thJC} Junction-to-Case	ALL	—	—	1.67	$^\circ\text{C/W}$	Mounting surface flat, smooth, and greased.
R_{thCS} Case-to-Sink	ALL	—	1.0	—	$^\circ\text{C/W}$	
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)	IRF530R IRF531R	—	—	14	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier. 
	IRF532R IRF533R	—	—	12	A	
I_{sm} Pulse Source Current (Body Diode) ③	IRF530R IRF531R	—	—	56	A	
	IRF532R IRF533R	—	—	48	A	
V_{SD} Diode Forward Voltage ②	IRF530R IRF531R	—	—	2.5	V	$T_c = 25^\circ\text{C}, I_s = 14\text{A}, \text{V}_{\text{GS}} = 0\text{V}$
	IRF532R IRF533R	—	—	2.3	V	$T_c = 25^\circ\text{C}, I_s = 12\text{A}, \text{V}_{\text{GS}} = 0\text{V}$
t_r Reverse Recovery Time	ALL	—	360	—	ns	$T_J = 150^\circ\text{C}, I_F = 14\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$
Q_{RR} Reverse Recovered Charge	ALL	—	2.1	—	μC	$T_J = 150^\circ\text{C}, I_F = 14\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$
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 $V_{DD} = 25\text{V}$, starting $T_J = 25^\circ\text{C}$, $L = 530\mu\text{H}$, $R_{es} = 25\Omega$, $I_{peak} = 14\text{A}$. See figures 15, 16.

IRF530R, IRF531R, IRF532R, IRF533R

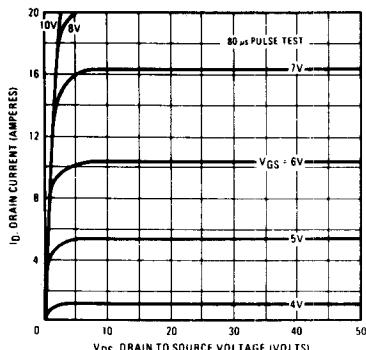


Fig. 1 – Typical Output Characteristics

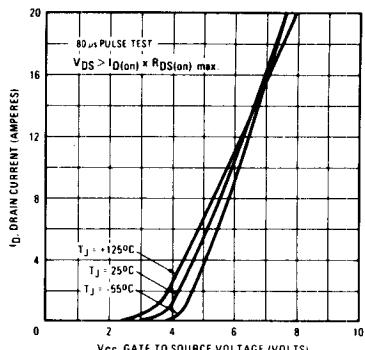


Fig. 2 – Typical Transfer Characteristics

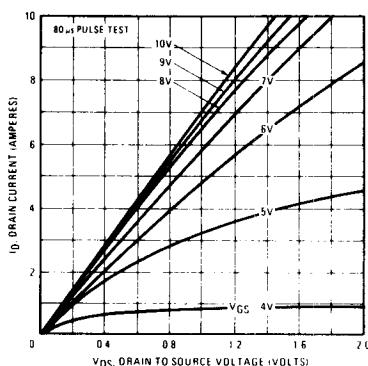


Fig. 3 – Typical Saturation Characteristics

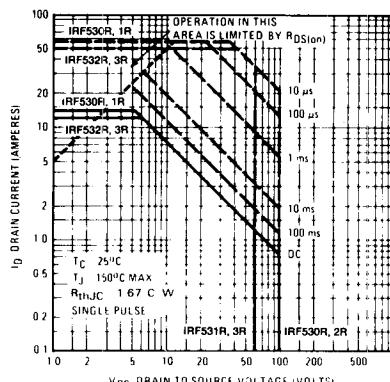


Fig. 4 – Maximum Safe Operating Area

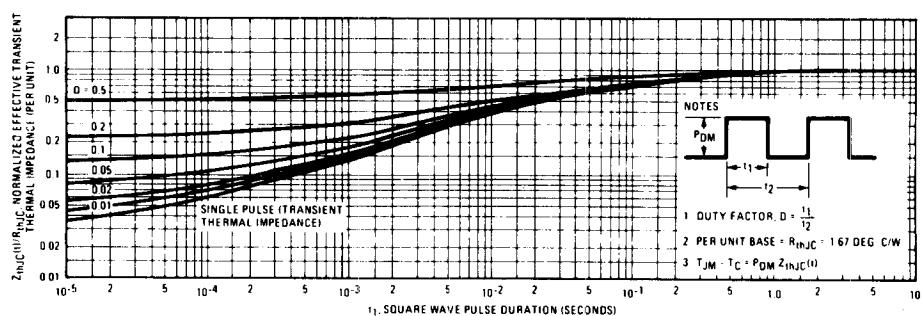


Fig. 5 – Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

IRF530R, IRF531R, IRF532R, IRF533R

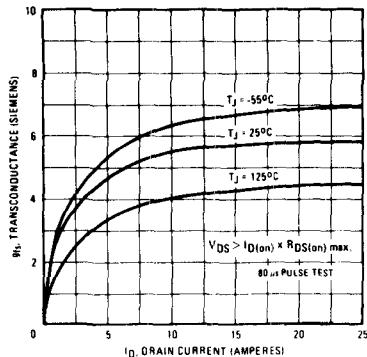


Fig. 6 – Typical Transconductance Vs. Drain Current

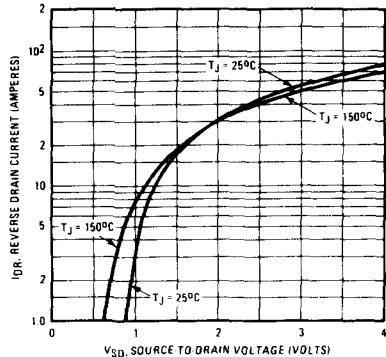


Fig. 7 – Typical Source-Drain Diode Forward Voltage

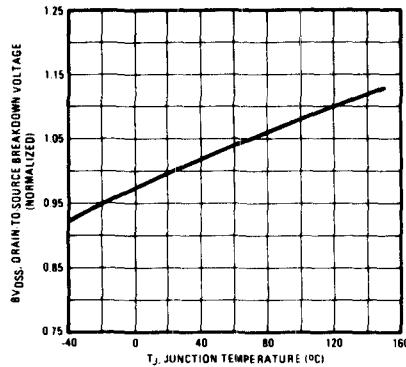


Fig. 8 – Breakdown Voltage Vs. Temperature

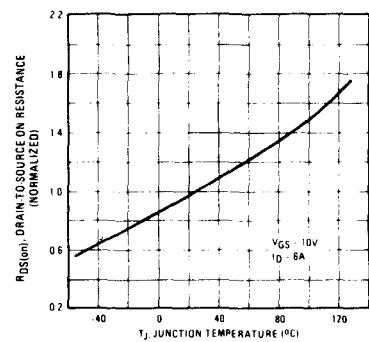


Fig. 9 – Normalized On-Resistance Vs. Temperature

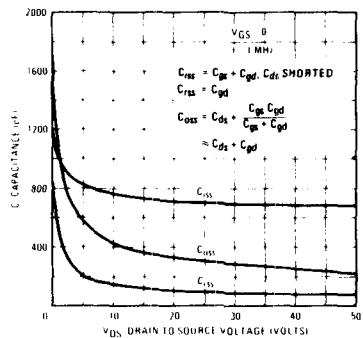


Fig. 10 – Typical Capacitance Vs. Drain-to-Source Voltage

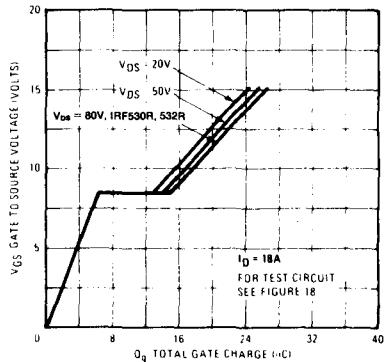


Fig. 11 – Typical Gate Charge Vs. Gate-to-Source Voltage

IRF530R, IRF531R, IRF532R, IRF533R

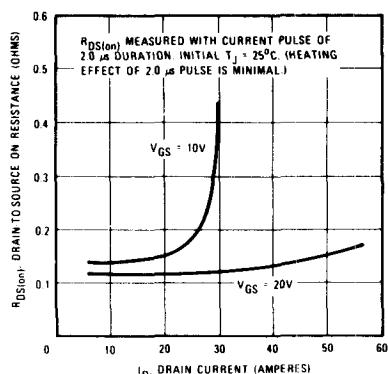


Fig. 12 – Typical On-Resistance Vs. Drain Current

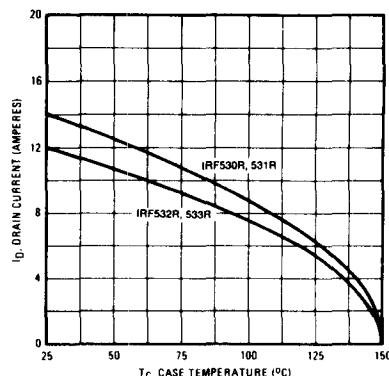


Fig. 13 – Maximum Drain Current Vs. Case Temperature

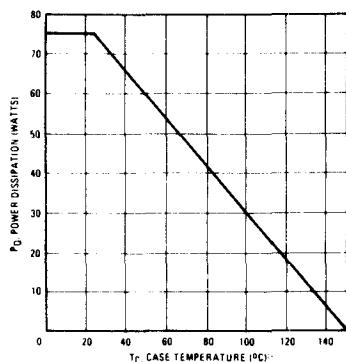


Fig. 14 – Power Vs. Temperature Derating Curve

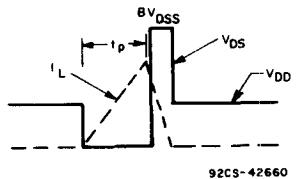


Fig. 16 – Unclamped Energy Waveforms

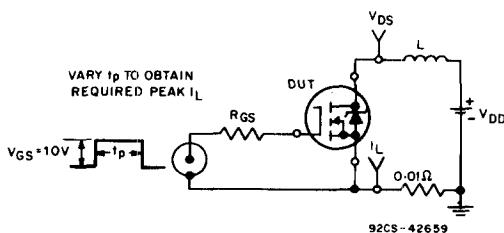


Fig. 15 – Unclamped Energy Test Circuit

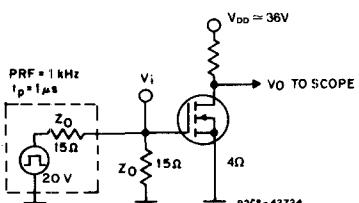


Fig. 17 – Switching Time Test Circuit

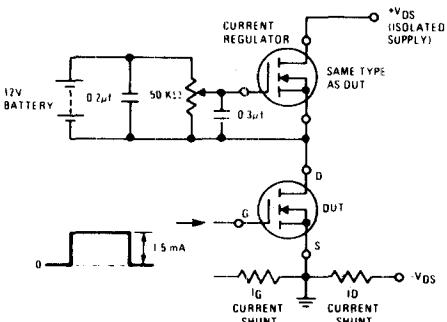


Fig. 18 – Gate Charge Test Circuit