

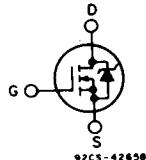
## Avalanche Energy Rated N-Channel Power MOSFETs

25A and 30A, 150V-200V  
 $r_{DS(on)} = 0.085\Omega$  and  $0.120\Omega$

### Features:

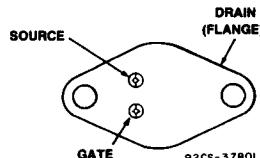
- Single pulse avalanche energy rated
- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance

### N-CHANNEL ENHANCEMENT MODE



### TERMINAL DIAGRAM

#### TERMINAL DESIGNATION



#### JEDEC TO - 204AE

The IRF250R, IRF251R, IRF252R and IRF253R 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-204AE metal package.

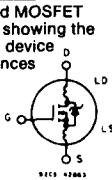
### Absolute Maximum Ratings

Parameter	IRF250R	IRF251R	IRF252R	IRF253R	Units
$V_{DS}$ Drain - Source Voltage ①	200	150	200	150	V
$V_{DGR}$ Drain - Gate Voltage ( $R_{GS} = 20\text{ k}\Omega$ ) ①	200	150	200	150	V
$I_D @ T_c = 25^\circ\text{C}$ Continuous Drain Current	30	30	25	25	A
$I_D @ T_c = 100^\circ\text{C}$ Continuous Drain Current	19	19	16	16	A
$I_{DM}$ Pulsed Drain Current ③	120	120	100	100	A
$V_{GS}$ Gate - Source Voltage			$\pm 20$		V
$P_d @ T_c = 25^\circ\text{C}$ Max. Power Dissipation			150 (See Fig. 14)		W
			1.2 (See Fig. 14)		$\text{W}/^\circ\text{C}$
$E_{AS}$ Single Pulse Avalanche Energy Rating ④			910		mj
$T_J$ $T_{Storage}$ Operating Junction and Storage Temperature Range			-55 to 150		$^\circ\text{C}$
Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				$^\circ\text{C}$

**IRF250R, IRF251R, IRF252R, IRF253R**

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

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
$\text{BV}_{\text{DSS}}$ Drain - Source Breakdown Voltage	IRF250R	200	—	—	V	$\text{V}_{\text{GS}} = 0\text{V}$
	IRF252R	150	—	—	V	$I_D = 250\mu\text{A}$
$\text{V}_{\text{GS(th)}}$ Gate Threshold Voltage	ALL	2.0	—	4.0	V	$\text{V}_{\text{DS}} = \text{V}_{\text{GS}}, I_D = 250\mu\text{A}$
$I_{\text{SS}}$ Gate-Source Leakage Forward	ALL	—	—	100	nA	$\text{V}_{\text{GS}} = 20\text{V}$
$I_{\text{RS}}$ Gate-Source Leakage Reverse	ALL	—	—	-100	nA	$\text{V}_{\text{GS}} = -20\text{V}$
$I_{\text{DS(0)}}$ Zero Gate Voltage Drain Current	ALL	—	—	250	$\mu\text{A}$	$\text{V}_{\text{DS}} = \text{Max. Rating}, \text{V}_{\text{GS}} = 0\text{V}$
	ALL	—	—	1000	$\mu\text{A}$	$\text{V}_{\text{DS}} = \text{Max. Rating} \times 0.8, \text{V}_{\text{GS}} = 0\text{V}, T_c = 125^\circ\text{C}$
$I_{\text{DS(on)}}$ On-State Drain Current ②	IRF250R	30	—	—	A	$\text{V}_{\text{DS}} > I_{\text{DS(on)}} \times R_{\text{DS(on)max}}, \text{V}_{\text{GS}} = 10\text{V}$
	IRF251R	25	—	—	A	
$R_{\text{DS(on)}}$ Static Drain-Source On-State Resistance ②	IRF250R	—	0.07	0.085	$\Omega$	$\text{V}_{\text{GS}} = 10\text{V}, I_D = 16\text{A}$
	IRF251R	—	0.09	0.120	$\Omega$	
$G_{\text{fs}}$ Forward Transconductance ②	ALL	8.0	14	—	S (A)	$\text{V}_{\text{DS}} > I_{\text{DS(on)max}}, I_D = 16\text{A}$
$C_{\text{iss}}$ Input Capacitance	ALL	—	2000	—	pF	$\text{V}_{\text{GS}} = 0\text{V}, \text{V}_{\text{DS}} = 25\text{V}, f = 1.0 \text{ MHz}$ See Fig. 10
$C_{\text{oss}}$ Output Capacitance	ALL	—	800	—	pF	
$C_{\text{res}}$ Reverse Transfer Capacitance	ALL	—	300	—	pF	$\text{V}_{\text{DD}} \approx 95\text{V}, I_D = 16\text{A}, Z_0 = 4.7\Omega$ See Fig. 17
$t_{\text{ton}}$ Turn-On Delay Time	ALL	—	—	35	ns	
$t_r$ Rise Time	ALL	—	—	100	ns	(MOSFET switching times are essentially independent of operating temperature.)
$t_{\text{toff}}$ Turn-Off Delay Time	ALL	—	—	125	ns	
$t_f$ Fall Time	ALL	—	—	100	ns	$\text{V}_{\text{GS}} = 10\text{V}, I_D = 38\text{A}, \text{V}_{\text{DS}} = 0.8\text{V Max. Rating}$ See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)
$Q_g$ Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	79	120	nC	
$Q_{\text{gs}}$ Gate-Source Charge	ALL	—	37	—	nC	Measured between the contact screw on header that is closer to source and gate pins and center of die.
$Q_{\text{gd}}$ Gate-Drain ("Miller") Charge	ALL	—	42	—	nC	
$L_D$ Internal Drain Inductance	ALL	—	5.0	—	nH	Modified MOSFET symbol showing the internal device inductances
$L_S$ Internal Source Inductance	ALL	—	12.5	—	nH	



**Thermal Resistance**

$R_{\text{thJC}}$ Junction-to-Case	ALL	—	—	0.83	$^\circ\text{C/W}$	
$R_{\text{thCS}}$ Case-to-Sink	ALL	—	0.1	—	$^\circ\text{C/W}$	Mounting surface flat, smooth, and greased.
$R_{\text{thJA}}$ Junction-to-Ambient	ALL	—	—	30	$^\circ\text{C/W}$	Free Air Operation

**Source-Drain Diode Ratings and Characteristics**

$I_S$	Continuous Source Current (Body Diode)	IRF250R IRF251R	—	—	30	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
		IRF252R IRF253R	—	—	25	A	
$I_{\text{SM}}$	Pulse Source Current (Body Diode) ③	IRF250R IRF251R	—	—	120	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
		IRF252R IRF253R	—	—	100	A	
$V_{\text{SD}}$	Diode Forward Voltage ②	IRF250R IRF251R	—	—	2.0	V	$T_c = 25^\circ\text{C}, I_S = 30\text{A}, \text{V}_{\text{GS}} = 0\text{V}$
		IRF252R IRF253R	—	—	1.8	V	
$t_{rr}$	Reverse Recovery Time	ALL	—	750	—	ns	$T_J = 150^\circ\text{C}, I_F = 30\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$
$Q_{RR}$	Reverse Recovered Charge	ALL	—	4.7	—	$\mu\text{C}$	$T_J = 150^\circ\text{C}, I_F = 30\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$
$t_{on}$	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  $150^\circ\text{C}$ . 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  $V_{\text{DD}} = 50\text{V}$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 1.5 \text{ mH}$ ,  $R_{\text{es}} = 50\Omega$ ,  $I_{\text{peak}} = 30\text{A}$ . See figures 15, 16.

## IRF250R, IRF251R, IRF252R, IRF253R

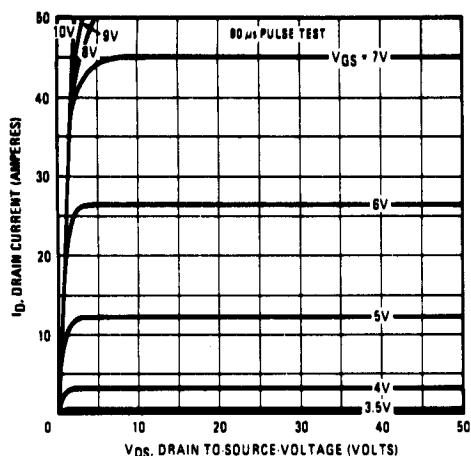


Fig. 1 – Typical Output Characteristics

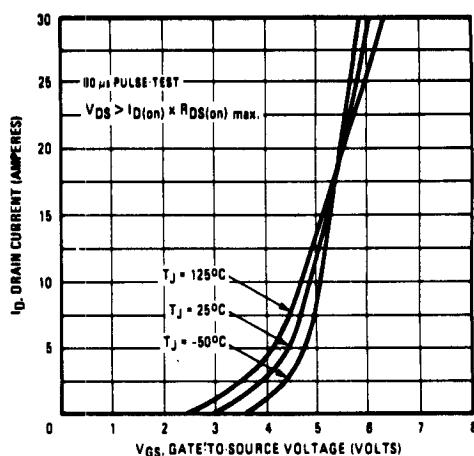


Fig. 2 – Typical Transfer Characteristics

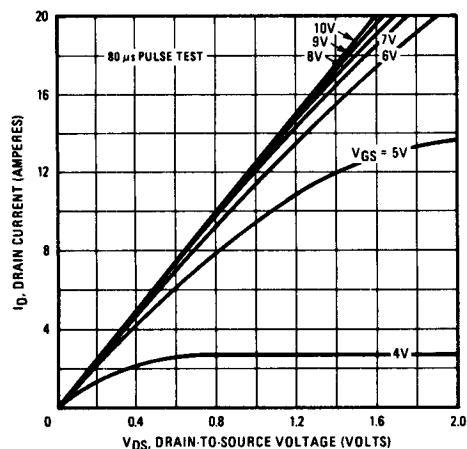


Fig. 3 – Typical Saturation Characteristics

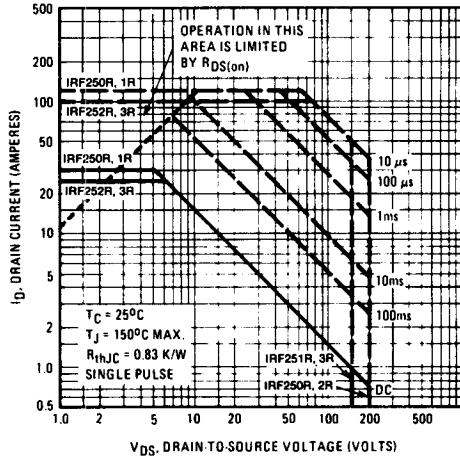


Fig. 4 – Maximum Safe Operating Area

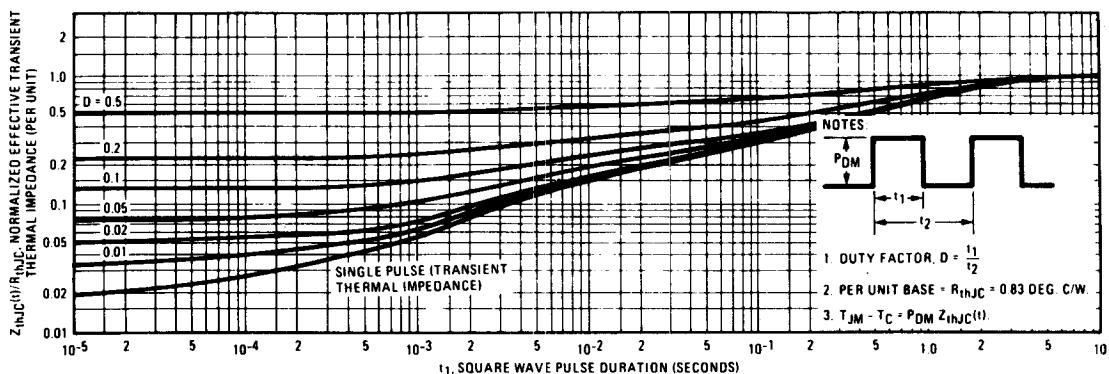


Fig. 5 – Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

## IRF250R, IRF251R, IRF252R, IRF253R

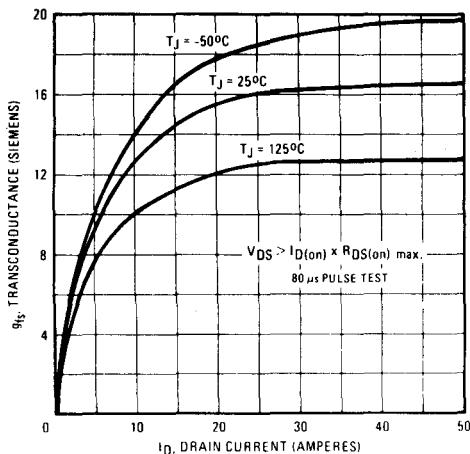


Fig. 6 – Typical Transconductance Vs. Drain Current

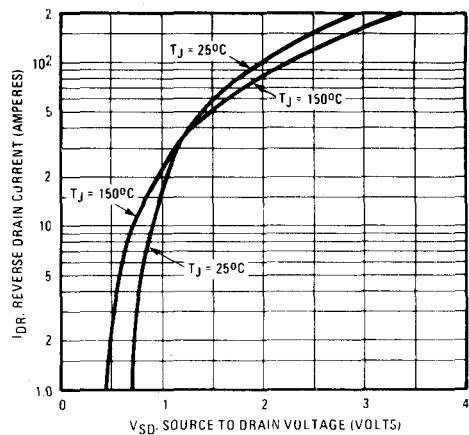


Fig. 7 – Typical Source-Drain Diode Forward Voltage

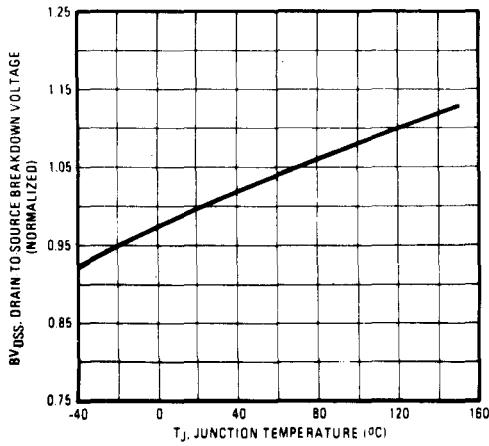


Fig. 8 – Breakdown Voltage Vs. Temperature

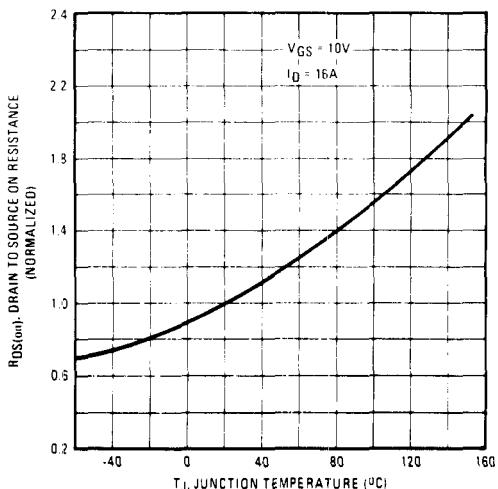


Fig. 9 – Normalized On-Resistance Vs. Temperature

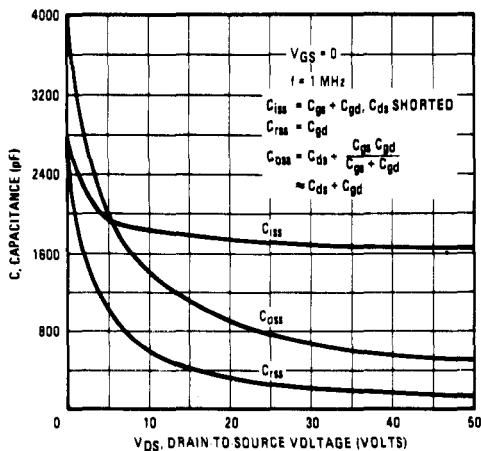


Fig. 10 – Typical Capacitance Vs. Drain-to-Source Voltage

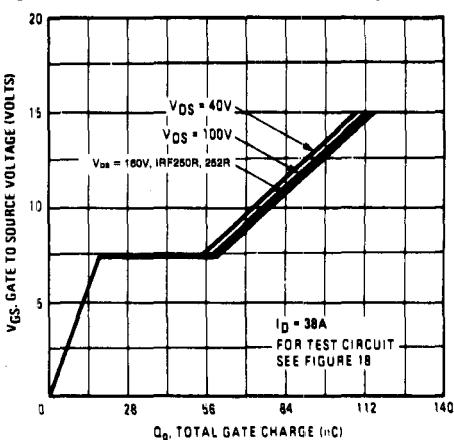


Fig. 11 – Typical Gate Charge Vs. Gate-to-Source Voltage

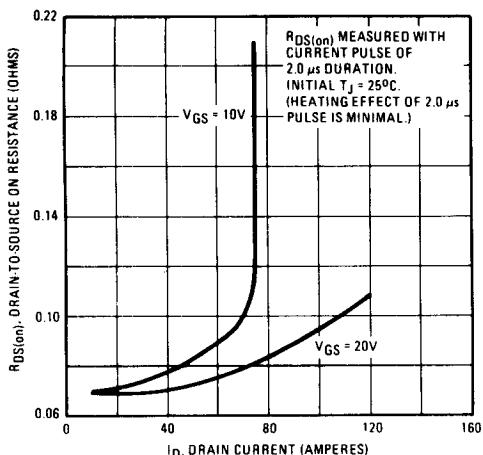
**IRF250R, IRF251R, IRF252R, IRF253R**

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

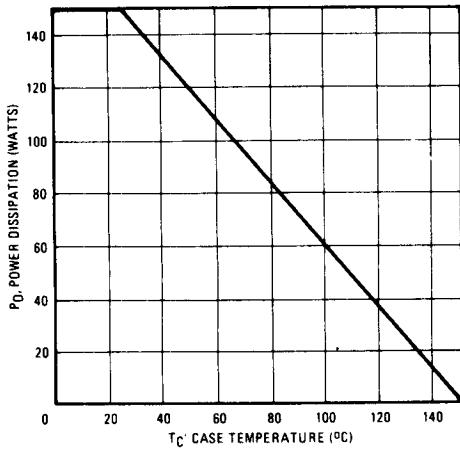


Fig. 14 – Power Vs. Temperature Derating Curve

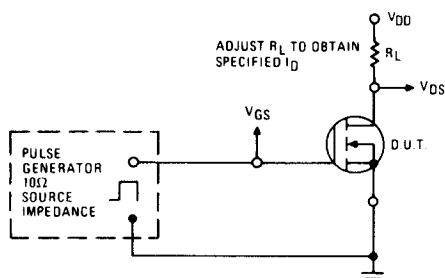


Fig. 17 – Switching Time Test Circuit

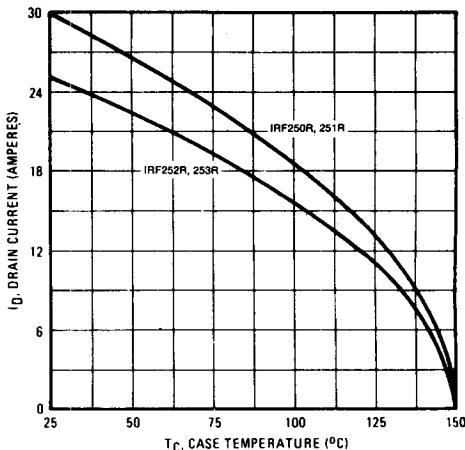


Fig. 13 – Maximum Drain Current Vs. Case Temperature

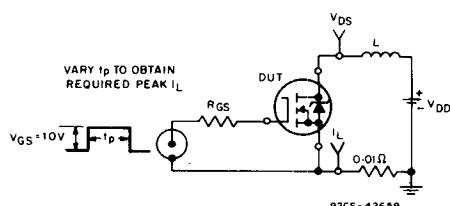


Fig. 15 – Unclamped Energy Test Circuit

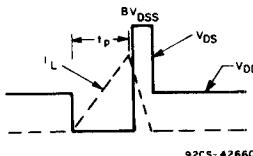


Fig. 16 – Unclamped Energy Waveforms

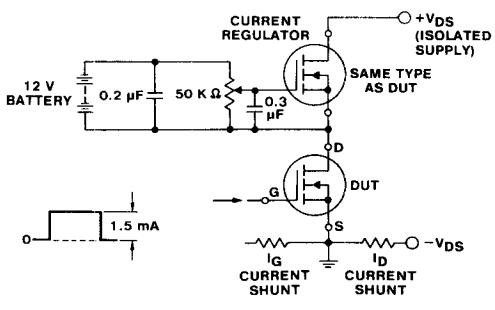


Fig. 18 – Gate Charge Test Circuit