

Avalanche Energy Rated N-Channel Power MOSFETs

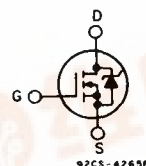
33A and 40A, 60V-100V

 $r_{DS(on)} = 0.055\Omega$ and 0.08Ω

Features:

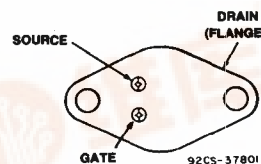
- Single pulse avalanche energy rated
- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance

N-CHANNEL ENHANCEMENT MODE



TERMINAL DIAGRAM

TERMINAL DESIGNATION



JEDEC TO - 204 AE

The IRF150R, IRF151R, IRF152R and IRF153R 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

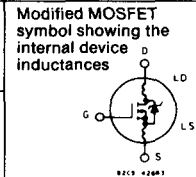
Parameter	IRF150R	IRF151R	IRF152R	IRF153R	Units
V_{DS} Drain - Source Voltage ①	100	60	100	60	V
V_{DGR} Drain - Gate Voltage ($R_{GS} = 20\text{ K}\Omega$) ①	100	60	100	60	V
$I_D @ T_C = 25^\circ\text{C}$ Continuous Drain Current	40	40	33	33	A
$I_D @ T_C = 100^\circ\text{C}$ Continuous Drain Current	25	25	20	20	A
I_{DM} Pulsed Drain Current ③	160	160	132	132	A
V_{GS} Gate - Source Voltage	± 20				V
$P_D @ T_C = 25^\circ\text{C}$ Max. Power Dissipation	150 (See Fig. 14)				W
Linear Derating Factor	1.2 (See Fig. 14)				W/ $^\circ\text{C}$
E_{AS} Single Pulse Avalanche Energy Rating ④	150				mJ
T_J Operating Junction and Storage Temperature Range	-55 to 150				$^\circ\text{C}$
T_{SL} Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				$^\circ\text{C}$

IRF150R, IRF151R, IRF152R, IRF153R

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	IRF150R IRF152R	100	—	—	V	$V_{GS} = 0V$
	IRF151R IRF153R	60	—	—	V	$I_D = 250\mu A$
$V_{GS(th)}$ 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	—	—	100	nA	$V_{GS} = 20V$
I_{GSS} Gate-Source Leakage Reverse	ALL	—	—	-100	nA	$V_{GS} = -20V$
I_{DSS} Zero Gate Voltage Drain Current	ALL	—	—	250	μA	$V_{DS} = \text{Max. Rating}, V_{GS} = 0V$
		—	—	1000	μA	$V_{DS} = \text{Max. Rating} \times 0.8, V_{GS} = 0V, T_c = 125^\circ\text{C}$
$I_{D(on)}$ On-State Drain Current ②	IRF150R IRF151R	40	—	—	A	$V_{DS} > I_{D(on)} \times R_{DS(on)max}, V_{GS} = 10V$
	IRF152R IRF153R	33	—	—	A	
$R_{DS(on)}$ Static Drain-Source On-State Resistance ②	IRF150R IRF151R	—	0.045	0.055	Ω	$V_{GS} = 10V, I_D = 20A$
	IRF152R IRF153R	—	0.06	0.08	Ω	
g_{fs} Forward Transconductance ②	ALL	9.0	11	—	S(V)	$V_{DS} > I_{D(on)} \times R_{DS(on)max}, I_D = 20A$
C_{iss} Input Capacitance	ALL	—	2000	—	pF	$V_{GS} = 0V, V_{DS} = 25V, f = 1.0\text{ MHz}$
C_{oss} Output Capacitance	ALL	—	1000	—	pF	See Fig. 10
C_{rss} Reverse Transfer Capacitance	ALL	—	350	—	pF	
$t_{d(on)}$ Turn-On Delay Time	ALL	—	—	35	ns	$V_{DD} = 24V, I_D = 20A, Z_\theta = 4.7\Omega$
t_r Rise Time	ALL	—	—	100	ns	See Fig. 17
$t_{d(off)}$ Turn-Off Delay Time	ALL	—	—	125	ns	(MOSFET switching times are essentially independent of operating temperature.)
t_f Fall Time	ALL	—	—	100	ns	
Q_g Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	63	120	nC	$V_{GS} = 10V, I_D = 50A, V_{DS} = 0.8V$ Max. Rating. See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)
Q_{gs} Gate-Source Charge	ALL	—	27	—	nC	
Q_{gd} Gate-Drain ("Miller") Charge	ALL	—	36	—	nC	
L_D Internal Drain Inductance	ALL	—	5.0	—	nH	Measured between the contact screw on header that is closer to source and gate pins and center of die.
L_S Internal Source Inductance	ALL	—	12.5	—	nH	Measured from the source pin, 6 mm (0.25 in.) from header and source bonding pad.

6



Thermal Resistance

$R_{\theta JC}$ Junction-to-Case	ALL	—	—	0.83	$^\circ\text{C/W}$	
$R_{\theta CS}$ Case-to-Sink	ALL	—	0.1	—	$^\circ\text{C/W}$	Mounting surface flat, smooth, and greased.
$R_{\theta JA}$ 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)	IRF150R IRF151R	—	—	40	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
	IRF152R IRF153R	—	—	33	A	
I_{SM} Pulse Source Current (Body Diode) ③	IRF150R IRF151R	—	—	160	A	
	IRF152R IRF153R	—	—	132	A	
V_{SD} Diode Forward Voltage ②	IRF150R IRF151R	—	—	2.5	V	$T_c = 25^\circ\text{C}, I_S = 40A, V_{GS} = 0V$
	IRF152R IRF153R	—	—	2.3	V	$T_c = 25^\circ\text{C}, I_S = 33A, V_{GS} = 0V$
t_{rr} Reverse Recovery Time	ALL	—	600	—	ns	$T_J = 150^\circ\text{C}, I_F = 40A, dI_F/dt = 100A/\mu s$
Q_{RR} Reverse Recovered Charge	ALL	—	3.3	—	μC	$T_J = 150^\circ\text{C}, I_F = 40A, dI_F/dt = 100A/\mu s$
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 $V_{DD} = 10V$, starting $T_J = 25^\circ\text{C}$, $L = 170\mu H$, $R_{DS} = 50\Omega$, $I_{peak} = 40A$. See figures 15, 16.

Rugged Power MOSFETs

IRF150R, IRF151R, IRF152R, IRF153R

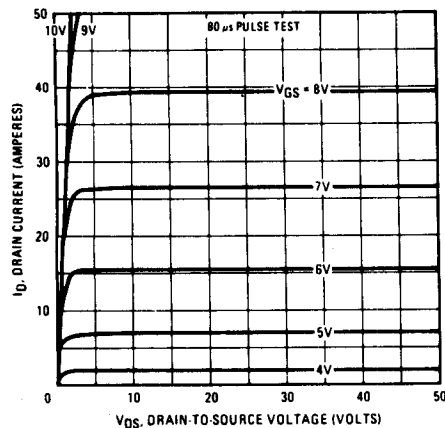


Fig. 1 - Typical Output Characteristics

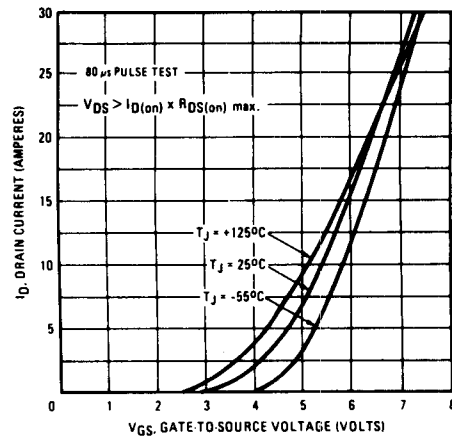


Fig. 2 - Typical Transfer Characteristics

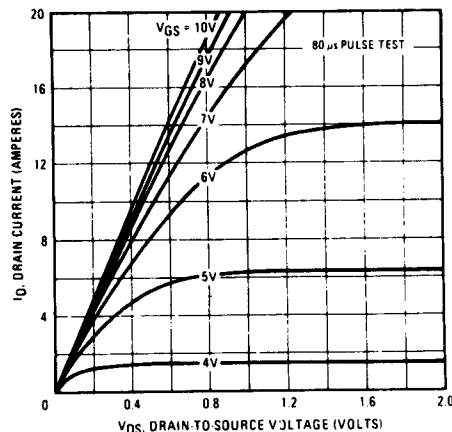


Fig. 3 - Typical Saturation Characteristics

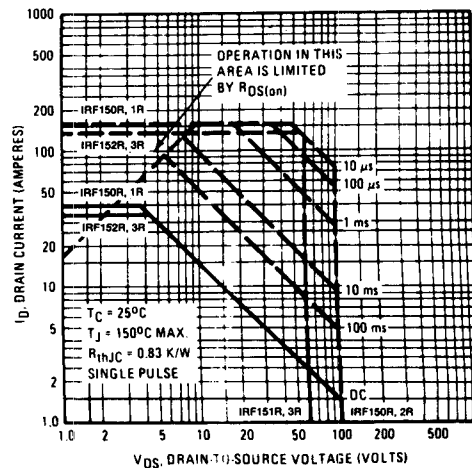


Fig. 4 - Maximum Safe Operating Area

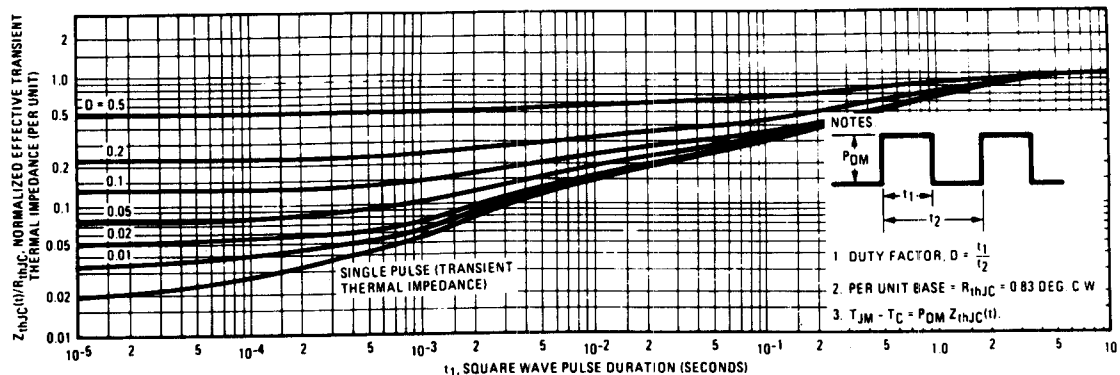


Fig. 5 - Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

IRF150R, IRF151R, IRF152R, IRF153R

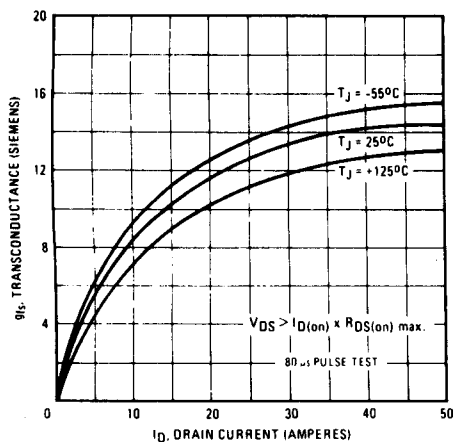


Fig. 6 – Typical Transconductance Vs. Drain Current

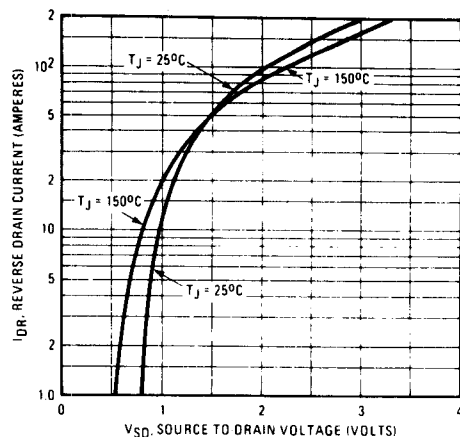


Fig. 7 -- Typical Source-Drain Diode Forward Voltage

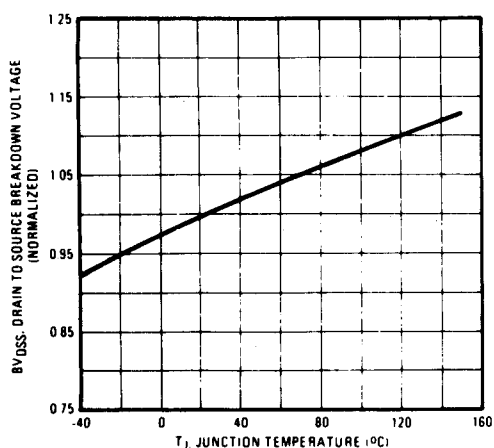


Fig. 8 – Breakdown Voltage Vs. Temperature

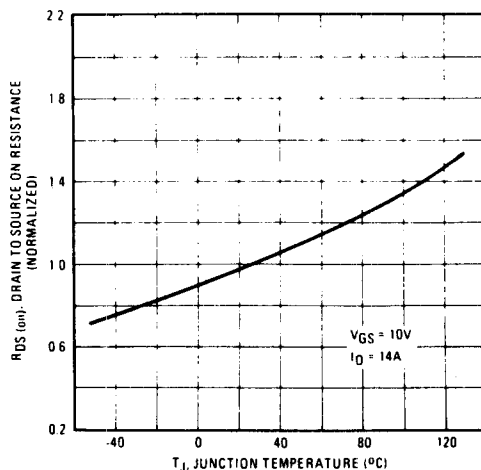


Fig. 9 – Normalized On-Resistance Vs. Temperature

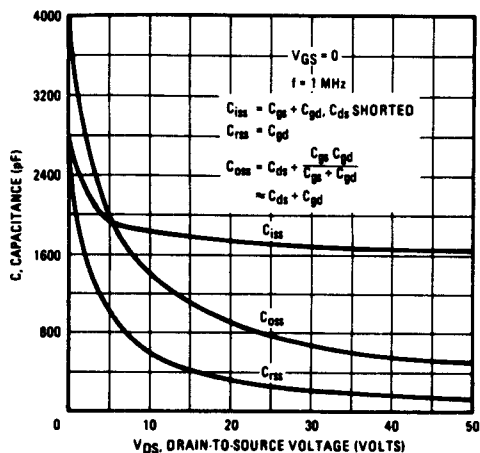


Fig. 10 – Typical Capacitance Vs. Drain-to-Source Voltage

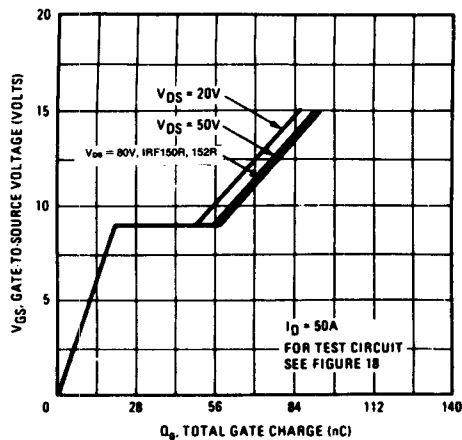


Fig. 11 – Typical Gate Charge Vs. Gate-to-Source Voltage

IRF150R, IRF151R, IRF152R, IRF153R

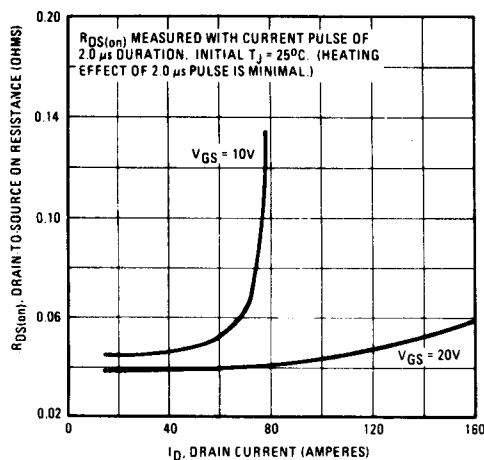


Fig. 12 — Typical On-Resistance Vs. Drain Current

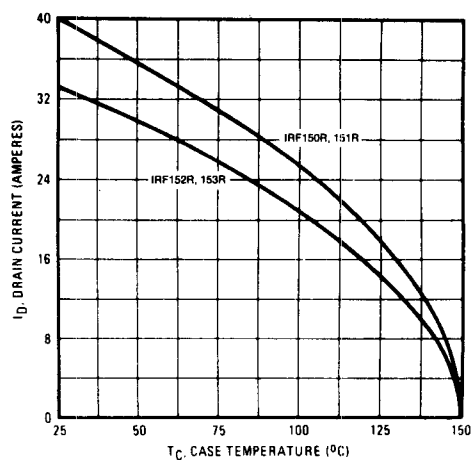


Fig. 13 — Maximum Drain Current Vs. Case Temperature

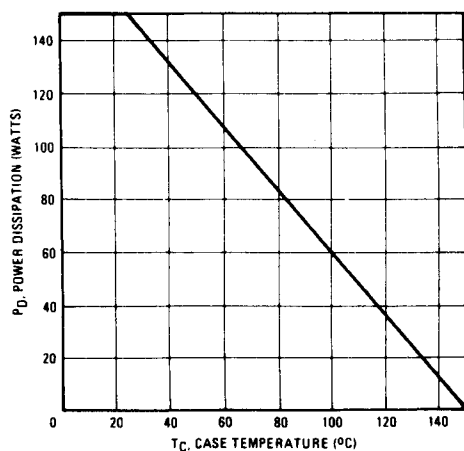


Fig. 14 — Power Vs. Temperature Derating Curve

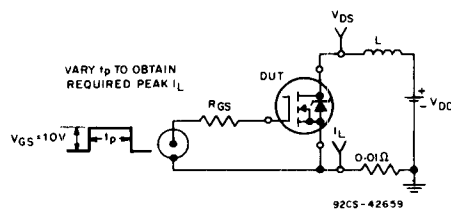


Fig. 15 — Unclamped Energy Test Circuit

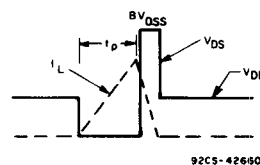


Fig. 16 — Unclamped Energy Waveforms

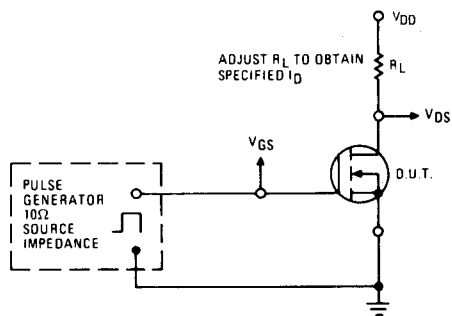


Fig. 17 — Switching Time Test Circuit

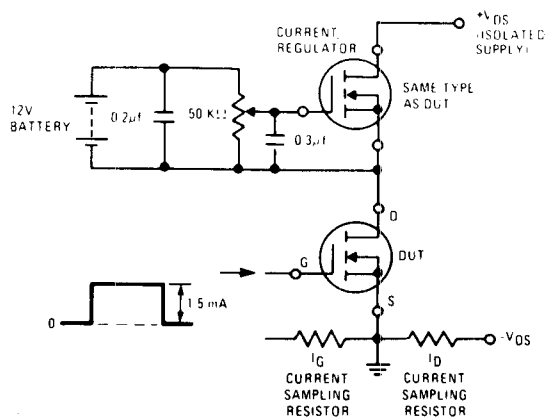


Fig. 18 — Gate Charge Test Circuit