

Power MOS Field-Effect Transistors

N-Channel Enhancement-Mode Power Field-Effect Transistors

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

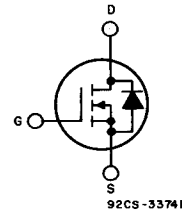
Features:

- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance
- Majority carrier device

The IRF250, IRF251, IRF252 and IRF253 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.

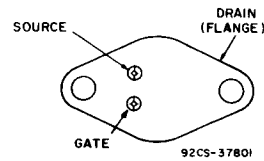
The IRF-types are supplied in the JEDEC TO-204AE metal package.

N-CHANNEL ENHANCEMENT MODE



TERMINAL DIAGRAM

TERMINAL DESIGNATION



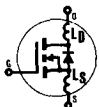
JEDEC TO-204AE

Absolute Maximum Ratings

Parameter	IRF250	IRF251	IRF252	IRF253	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	± 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/ $^\circ\text{C}$
I_{LM} Inductive Current, Clamped	(See Fig. 15 and 16) $L = 100\mu\text{H}$				A
	120	120	100	100	
T_J Operating Junction and Storage Temperature Range	-55 to 150				$^\circ\text{C}$
T_{stg} Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				$^\circ\text{C}$

IRF250, IRF251, IRF252, IRF253

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		IRF250	200	—	—	V	V _{GS} = 0V	
		IRF252						
		IRF251	150	—	—	V	I _D = 250μA	
		IRF253						
V _{GS(th)} Gate Threshold Voltage		ALL	2.0	—	4.0	V	V _{DS} = V _{GS} , I _D = 250μA	
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} = Max. Rating, V _{GS} = 0V	V _{DS} = Max. Rating x 0.8, V _{GS} = 0V, T _C = 125°C
			—	—	1000	μA		
I _{D(on)} On-State Drain Current ②		IRF250	30	—	—	A	V _{DS} > I _{D(on)} × R _{DS(on)} max., V _{GS} = 10V	
		IRF251						
		IRF252	25	—	—	A		
		IRF253						
R _{DS(on)} Static Drain-Source On-State Resistance ②		IRF250	—	0.07	0.085	Ω	V _{GS} = 10V, I _D = 16A	
		IRF251						
		IRF252	—	0.09	0.120	Ω		
		IRF253						
g _{fs} Forward Transconductance ②		ALL	8.0	14	—	S (Ω)	V _{DS} > I _{D(on)} × R _{DS(on)} max., I _D = 16A	
C _{iss} Input Capacitance		ALL	—	2000	—	pF	V _{GS} = 0V, V _{DS} = 25V, f = 1.0 MHz See Fig. 10	
C _{oss} Output Capacitance		ALL	—	800	—	pF		
C _{rss} Reverse Transfer Capacitance		ALL	—	300	—	pF		
t _{d(on)} Turn-On Delay Time		ALL	—	—	35	ns	V _{DD} = 95V, I _D = 16A, Z _o = 4.7Ω See Fig. 17 (MOSFET switching times are essentially independent of operating temperature.)	
t _r Rise Time		ALL	—	—	100	ns		
t _{d(off)} Turn-Off Delay Time		ALL	—	—	125	ns		
t _f Fall Time		ALL	—	—	100	ns		
Q _g Total Gate Charge (Gate-Source Plus Gate-Drain)		ALL	—	79	120	nC	V _{GS} = 10V, I _D = 38A, V _{DS} = 0.8 Max. Rating. See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)	
Q _{gs} Gate-Source Charge		ALL	—	37	56	nC		
Q _{gd} Gate-Drain ("Miller") Charge		ALL	—	42	63	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.	Modified MOSFET symbol showing the internal device inductances.
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.	

Thermal Resistance

R _{thJC} Junction-to-Case	ALL	—	—	0.83	°C/W	
R _{thCS} Case-to-Sink	ALL	—	0.1	—	°C/W	Mounting surface flat, smooth, and greased.
R _{thJA} Junction-to-Ambient	ALL	—	—	30	°C/W	Free Air Operation

Source-Drain Diode Ratings and Characteristics

I _S	Continuous Source Current (Body Diode)	IRF250	—	—	30	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.	
		IRF251	—	—	25	A		
I _{SM}	Pulse Source Current (Body Diode) ③	IRF250	—	—	120	A		
		IRF251	—	—	100	A		
		IRF252	—	—	—	—		
V _{SD}	Diode Forward Voltage ②	IRF250	—	—	2.0	V	T _C = 25°C, I _S = 30A, V _{GS} = 0V	
		IRF251	—	—	—	—		
		IRF252	—	—	1.8	V	T _C = 25°C, I _S = 25A, V _{GS} = 0V	
t _{rr}	Reverse Recovery Time	ALL	—	750	—	ns	T _J = 150°C, I _F = 30A, dI _F /dt = 100A/μs	
Q _{RR}	Reverse Recovered Charge	ALL	—	4.7	—	μC	T _J = 150°C, I _F = 30A, dI _F /dt = 100A/μs	
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°C to 150°C.② Pulse Test: Pulse width $\leq$ 300 μ s, Duty Cycle $\leq$ 2%.

③ Repetitive Rating: Pulse width limited

by max. junction temperature.

See Transient Thermal Impedance Curve (Fig. 5).

IRF250, IRF251, IRF252, IRF253

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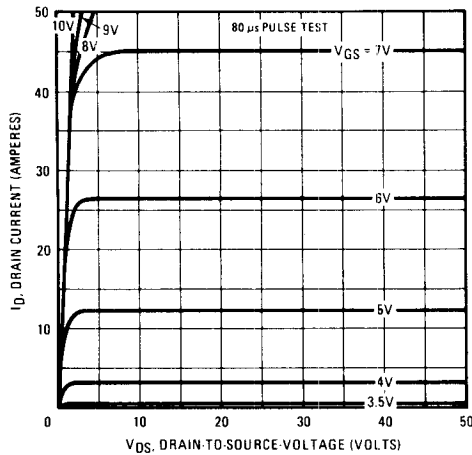


Fig. 1 – Typical Output Characteristics

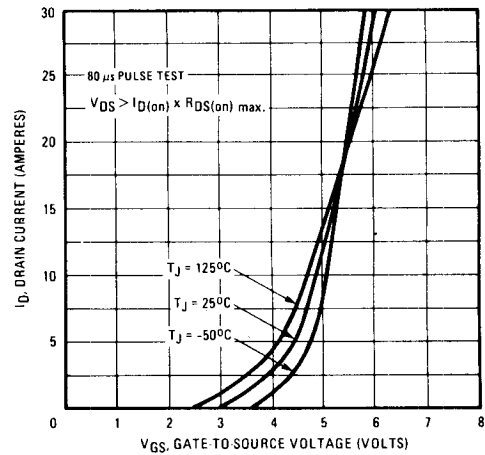


Fig. 2 – Typical Transfer Characteristics

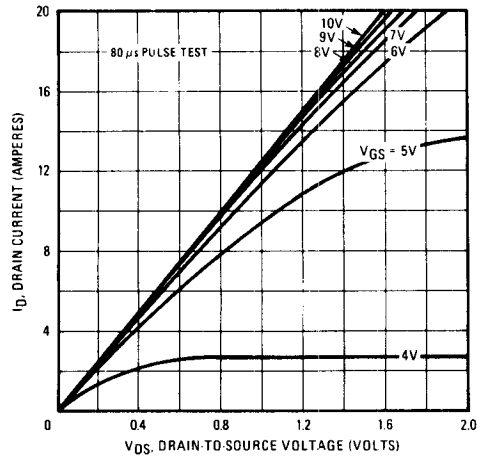


Fig. 3 – Typical Saturation Characteristics

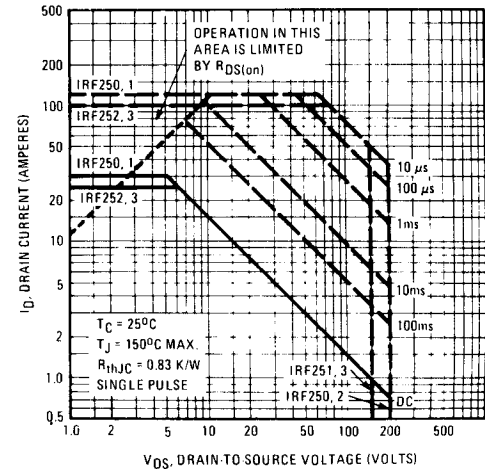


Fig. 4 – Maximum Safe Operating Area

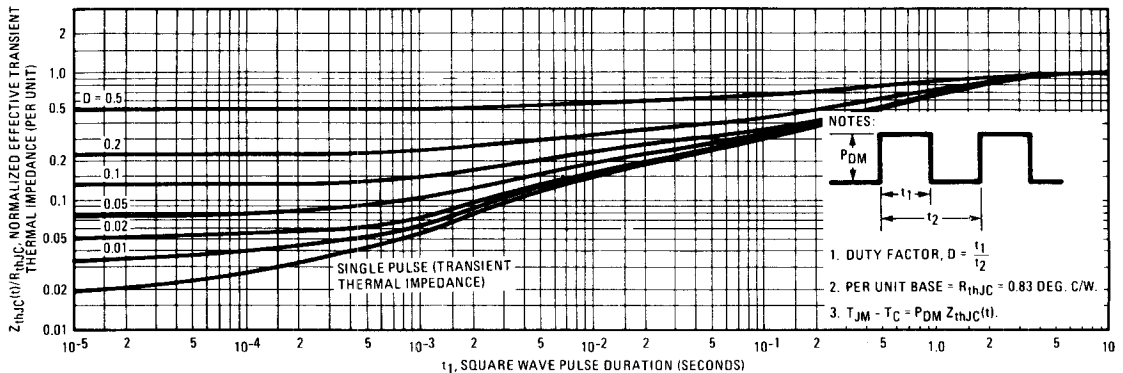


Fig. 5 – Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

IRF250, IRF251, IRF252, IRF253

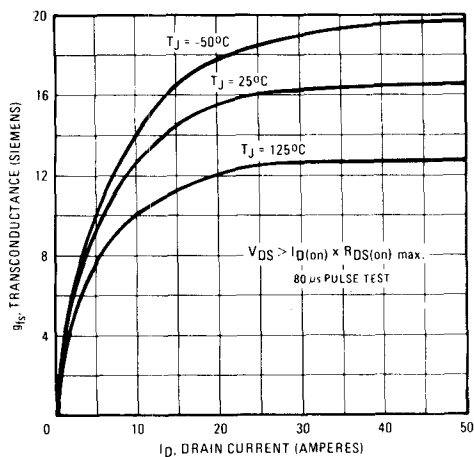


Fig. 6 — Typical Transconductance Vs. Drain Current

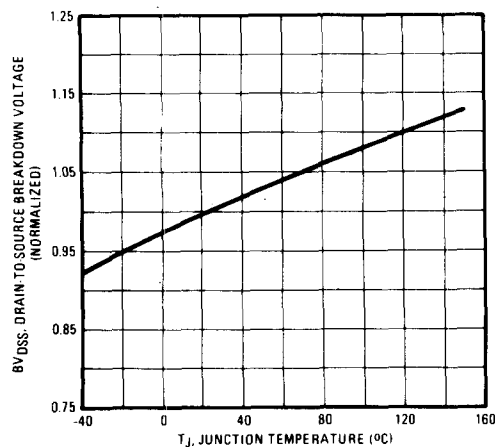


Fig. 8 — Breakdown Voltage Vs. Temperature

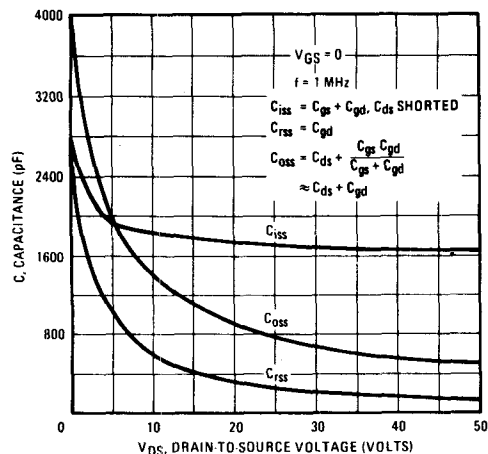


Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

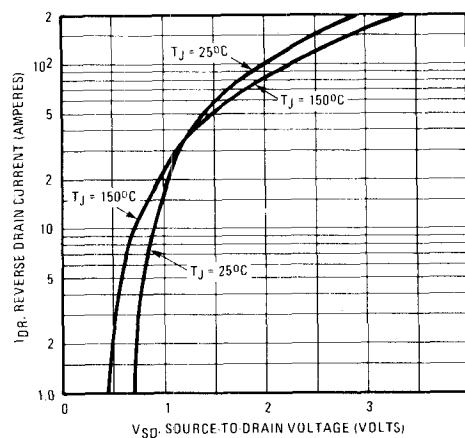


Fig. 7 — Typical Source-Drain Diode Forward Voltage

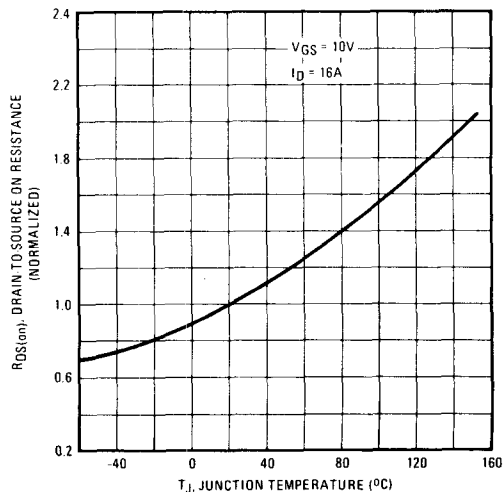


Fig. 9 — Normalized On-Resistance Vs. Temperature

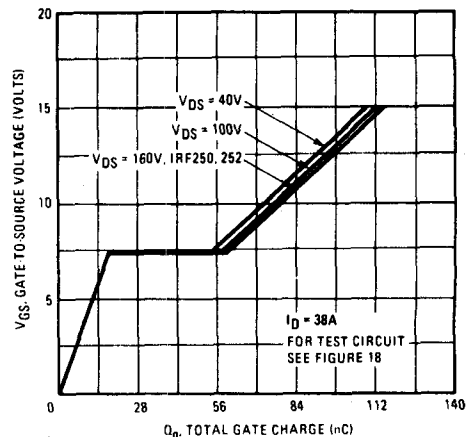


Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

IRF250, IRF251, IRF252, IRF253

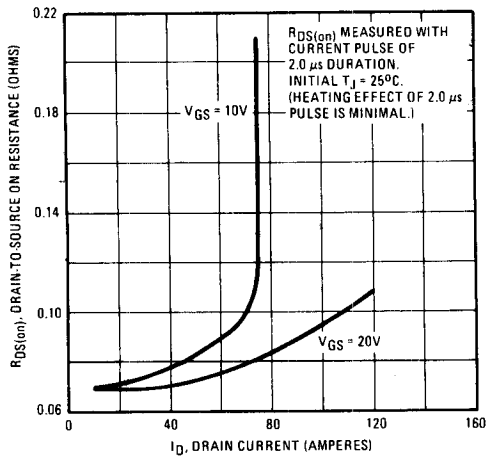


Fig. 12 - Typical On-Resistance Vs. Drain Current

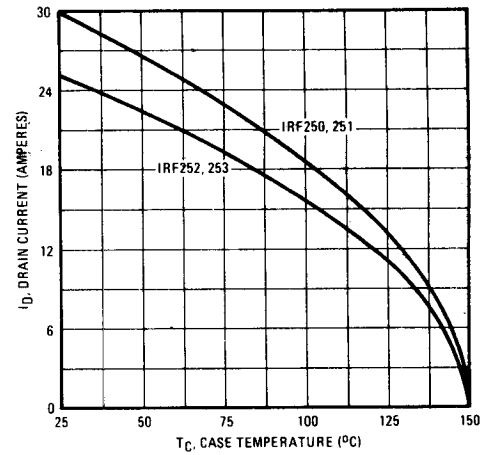


Fig. 13 - Maximum Drain Current Vs. Case Temperature

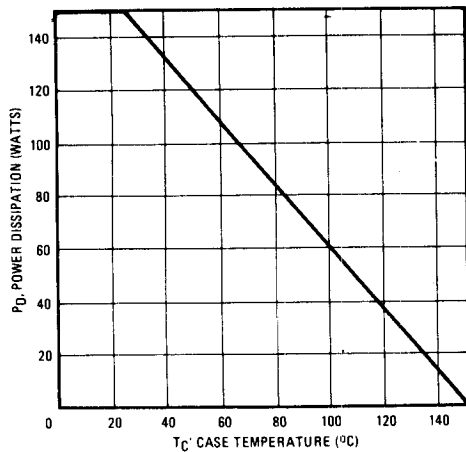


Fig. 14 - Power Vs. Temperature Derating Curve

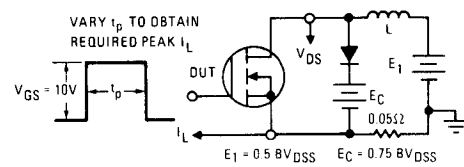


Fig. 15 - Clamped Inductive Test Circuit

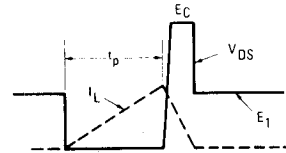


Fig. 16 - Clamped Inductive Waveforms

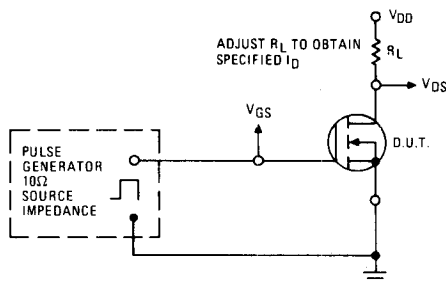


Fig. 17 - Switching Time Test Circuit

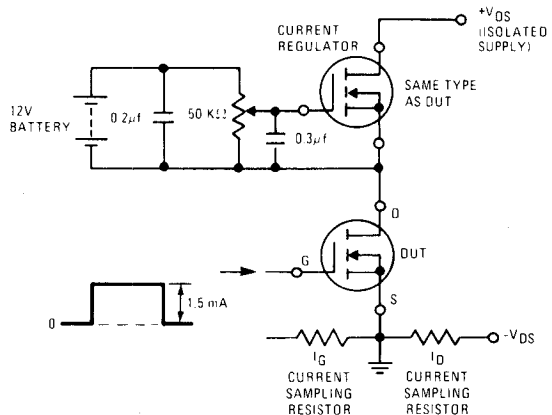


Fig. 18 - Gate Charge Test Circuit