



**N - CHANNEL ENHANCEMENT MODE
POWER MOS TRANSISTORS**

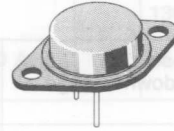
TYPE	V _{DS}	R _{DS(on)}	I _D
IRF450	500 V	0.4 Ω	13 A
IRF451	450 V	0.4 Ω	13 A
IRF452	500 V	0.5 Ω	11 A
IRF453	450 V	0.5 Ω	11 A

- HIGH VOLTAGE - 450V FOR OFF LINE SMPS
- HIGH CURRENT - 11A FOR UP TO 350W SMPS
- ULTRA FAST SWITCHING - FOR OPERATION AT > 100 KHz
- EASY DRIVE - REDUCES COST AND SIZE
- HERMETIC PACKAGE TO-3

INDUSTRIAL APPLICATIONS:

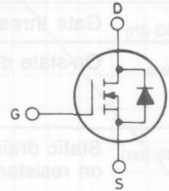
- SWITCHING POWER SUPPLIES
- MOTOR CONTROLS

N - channel enhancement mode POWER MOS field effect transistors. Easy drive and very fast switching times make these POWER MOS transistors ideal for high speed switching applications. Typical applications include switched mode power supplies, uninterruptable power supplies and motor speed control.



TO-3

**INTERNAL SCHEMATIC
DIAGRAM**



ABSOLUTE MAXIMUM RATINGS

		IRF				
		450	451	452	453	
V _{DS} *	Drain-source voltage (V _{GS} = 0)	500	450	500	450	V
V _{DGR} *	Drain-gate voltage (R _{GS} = 20 KΩ)	500	450	500	450	V
V _{GS}	Gate-source voltage			±20		V
I _D	Drain current (cont.) at T _c = 25°C	13	13	11	11	A
I _D	Drain current (cont.) at T _c = 100°C	8.1	8.1	7.2	7.2	A
I _{DM} (*)	Drain current (pulsed)	52	52	44	44	A
I _{DLM}	Drain inductive current, clamped (L = 100 μH)	52	52	44	44	A
P _{tot}	Total dissipation at T _c < 25°C		150			W
	Derating factor		1.2			W/°C
T _{stg}	Storage temperature		-55 to 150			°C
T _j	Max. operating junction temperature		150			°C

* T_j = 25°C to 125°C

(*) Repetitive Rating: Pulse width limited by max junction temperature

THERMAL DATA

$R_{thj - case}$	Thermal resistance junction-case	max	0.83	°C/W
R_{thc-s}	Thermal resistance case-sink	typ	0.1	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	max	30	°C/W
T_l	Maximum lead temperature for soldering purpose		300	°C

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^\circ\text{C}$ unless otherwise specified)

Parameters	Test Conditions	Min.	Typ.	Max.	Unit
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OFF

$V_{(BR) DSS}$	Drain-source breakdown voltage	$I_D = 250 \mu\text{A}$ for IRF450/IRF452 for IRF451/IRF453	$V_{GS} = 0$	500 450		V V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$	$T_c = 125^\circ\text{C}$		250 1000	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20 \text{ V}$			± 100	nA

ON **

$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$	$I_D = 250 \mu\text{A}$	2		4	V
$I_{D(on)}$	On-state drain current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ for IRF450/IRF451 for IRF452/IRF453	$V_{GS} = 10 \text{ V}$	13 11			A A
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}$ for IRF450/IRF451 for IRF452/IRF453	$I_D = 7.2 \text{ A}$			0.4 0.5	Ω Ω

DYNAMIC

g_{fs}^{**}	Forward transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 7.2 \text{ A}$		8.7			mho
C_{iss}	Input capacitance					3000	pF
C_{oss}	Output capacitance	$V_{DS} = 25 \text{ V}$	$f = 1 \text{ MHz}$			600	pF
C_{riss}	Reverse transfer capacitance	$V_{GS} = 0$				200	pF

SWITCHING

$t_{d(on)}$	Turn-on time	$V_{DD} = 210 \text{ V}$	$I_D = 7.0 \text{ A}$			35	ns
t_r	Rise time	$R_l = 4.7 \Omega$	(see test circuit)			50	ns
$t_{d(off)}$	Turn-off delay time					150	ns
t_f	Fall time					70	ns
Q_g	Total Gate Charge	$V_{GS} = 10 \text{ V}$ $V_{DS} = \text{Max Rating} \times 0.8$	$I_D = 13 \text{ A}$			120	nC
		(see test circuit)					

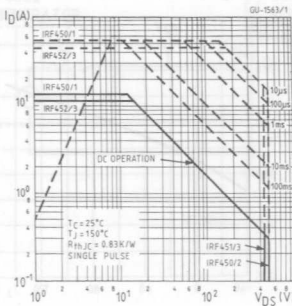
ELECTRICAL CHARACTERISTICS (Continued)

Parameters		Test Conditions		Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current					13	A
$I_{SDM}^{(*)}$	Source-drain current (pulsed)					52	A
V_{SD}^{**}	Forward on voltage	$I_{SD} = 13\text{ A}$	$V_{GS} = 0$			1.4	V
t_{rr}	Reverse recovery time	$T_J = 150^\circ\text{C}$			1300		ns
Q_{rr}	Reverse recovered charge	$I_{SD} = 13\text{ A}$	$di/dt = 100\text{ A}/\mu\text{s}$		7.4		μC

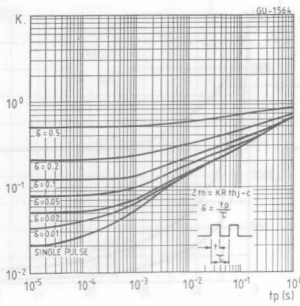
** Pulsed: Pulse duration $\leq 300\ \mu\text{s}$, duty cycle $\leq 1.5\%$

(*) Repetitive Rating: Pulse width limited by max junction temperature

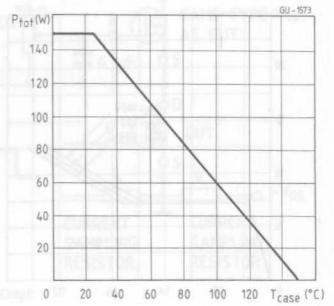
Safe operating areas



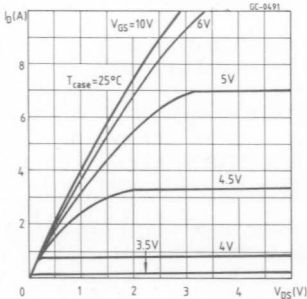
Thermal impedance



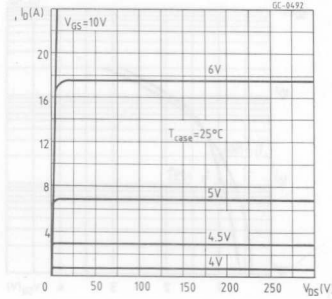
Derating curve



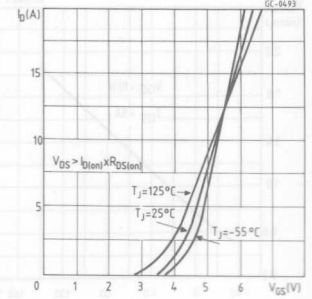
Output characteristics



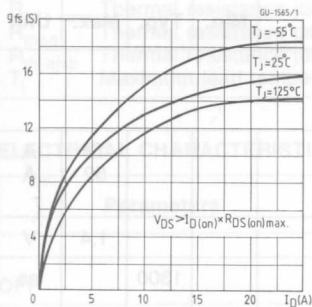
Output characteristics



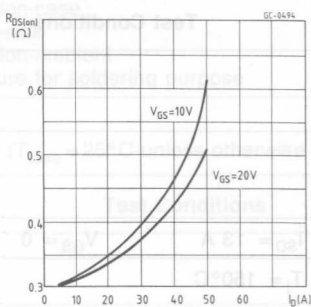
Transfer characteristics



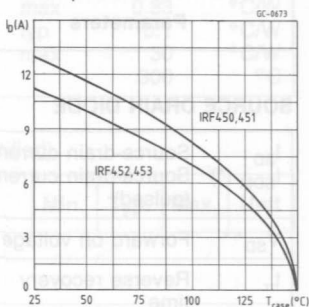
Transconductance



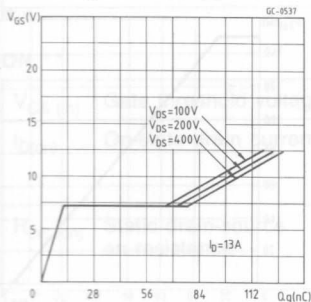
Static drain-source on resistance



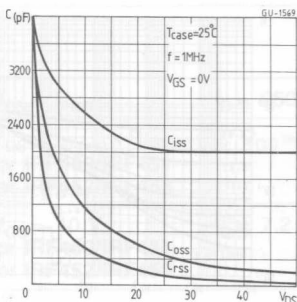
Maximum drain current vs temperature



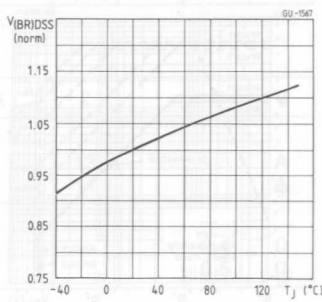
Gate charge vs gate-source voltage



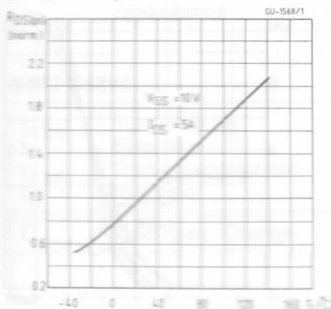
Capacitance variation



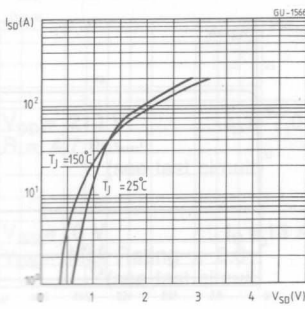
Normalized breakdown voltage vs temperature



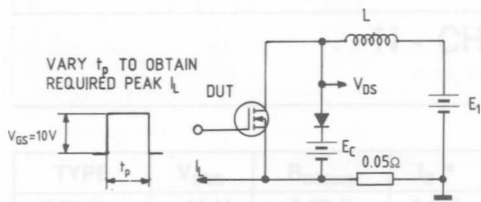
Normalized on resistance vs temperature



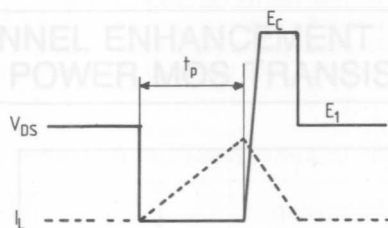
Source-drain diode forward characteristics



Clamped inductive test circuit



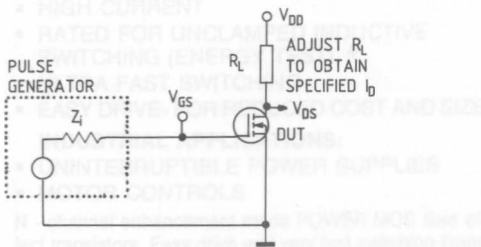
Clamped inductive waveforms



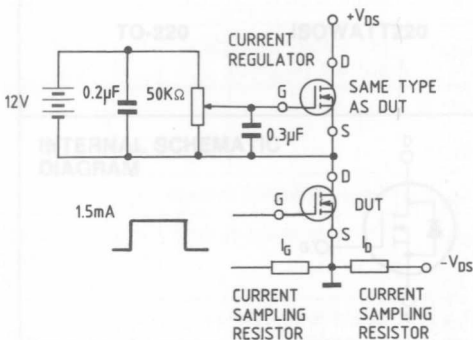
TYPE	VGS	VDS	IC	IP
IRF520	100 V	100 V	0.27 Ω	8.1 A
IRF520FI	100 V	100 V	0.27 Ω	7 A
IRF521	80 V	80 V	0.27 Ω	9.2 A
IRF521FI	80 V	80 V	0.27 Ω	8 A
IRF522	100 V	100 V	0.36 Ω	8 A
IRF522FI	100 V	100 V	0.36 Ω	6 A
IRF523	80 V	80 V	0.36 Ω	8 A
IRF523FI	80 V	80 V	0.36 Ω	6 A

SC-0242

Switching times test circuit



Gate charge test circuit



SC-0246

ABSOLUTE MAXIMUM RATINGS

	TO-220 ISOWATT220	IRF			
		450 520FI	521 521FI	452 522FI	453 523FI
VDS*	Drain-source voltage (VGS = 0)	100	80	100	80
VDSM*	Drain-gate voltage (RDS(on) = 20 mΩ)	100	80	100	80
VGS	Gate-source voltage	±20			
IDM(*)	Drain current (pulsed)	37	37	32	32
IGM	Drain current (cont.) at Tj = 25°C	9.2	9.2	8	8
IG	Drain current (cont.) at Tj = 100°C	6.5	6.5	5.6	5.6
IG*	Drain current (cont.) at Tj = 25°C	7	7	6	6
IG*	Drain current (cont.) at Tj = 100°C	4	4	3.5	3.5
FDLM*	Total dissipation at Tj = 25°C	TO-220		ISOWATT220	
FDLM	Dissipating factor	60		30	
FDLM	Storage temperature	0.48		0.24	
Tjmax	Max. operating junction temperature	-55 to 150			
Tj		150			

* Tj = 25°C to 125°C

(*) Repetitive Rating: Pulse width limited by max. junction temperature

* See note on ISOWATT220 on this datasheet.

* Introduced in 1995 week 44